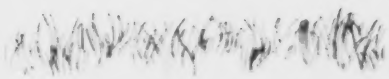
A Landowner's Guide

Conservation of Canadian Prairie Grasslands



Environment Canada — Canadian Wildlife Service
World Wildlife Fund — Prairie For Tomorrow
North American Waterfowl Management Plan — Prairie Habitat Joint Venture

92-02696/

Copyright © Minister of Supply and Services Canada, 1992

First printed 1992

Published by Authority of the
Minister of Environment
Canadian Wildlife Service

Single copies available from:
Communications Branch
Environment Canada, Western and Northern Region
Twin Atria II, Second Floor
4999 – 98 Avenue
Edmonton, Alberta T6B 2X3

Canadian Cataloguing in Publication Data
Trottier, Garry C. (Garry Charles), 1946-
Conservation of Canadian Prairie Grasslands: A Landowner's Guide
Includes bibliographical references.
ISBN 0-662-19324-5
DSS cat. no. CW66-120/1992E
1. Pastures — Prairie Provinces — Environmental aspects. 2. Meadows — Prairie Provinces — Environmental aspects. 3. Range management — Prairie Management — Handbook, manuals, etc. 4. Grassland ecology — Prairie Provinces.
I. Canadian Wildlife Service. II. Title.
SB199.T76 1992 574.5'2643'09712 C92-099542-X

Design and Typesetting: Personal Publishing Ltd.
Cover Photos: D. Wood, top; C. Davar, centre left and bottom; J. Morgan, centre right

Prairie Habitat Joint Venture

Environment Canada
Canadian Wildlife Service

Environnement Canada
Service canadien de la faune

WWF World Wildlife Fund
* TM of WWF — World Wide Fund of Nature, Switzerland

Contents

Chapter 1 — Introduction 1
Prairie Under Siege 1
Where Do We Go From Here? 2
About This Guide 3

Chapter 2 — Grasslands of the Canadian Prairies 5
Tallgrass Prairie 7
Mixed Prairie 13
Fescue Prairie 23
Sandhills 31

Chapter 3 — Conserving Grasslands — Management Considerations 35
Recognizing the Ecological System 35
How to Prepare a Management Plan 36

Chapter 4 — Assessing Grassland Condition 44

Chapter 5 — Choosing the Appropriate Management Tools 50
Rest — When and How Much 50
Livestock Grazing 52
Prescribed Burning 62
Grassland Restoration 70

Appendix 1 — Glossary of Terms 78

Appendix 2 — Recommended Reading 79

Plant Identification Guides 79

Grazing and Range Management 79

Prescribed Burning 79

Grassland Conservation 80

Wildlife Habitat Management 80

Grassland Restoration 80

Appendix 3 — Native Seed Suppliers 81

Appendix 4 — Sources of Expert Assistance 82

Plant Identification 82

Prairie Restoration 83

Appendix 5 — Financial Incentive Programs 84

Prairie-Wide Programs 84

Alberta Programs 85

Manitoba Programs 85

Saskatchewan Programs 85

Appendix 6 — Habitat Preferences of Selected Wildlife Species 86

Appendix 7 — Plant Species Mentioned in This Guide 87

Appendix 8 — Acknowledgements 92

Chapter 1
Introduction

"The vast ocean of level prairie which lies to the west of Red River must be seen in its extraordinary aspects, before it can be rightly valued and understood in reference to its future occupation by an energetic and civilised race, able to improve its vast capabilities and appreciate its marvellous beauties. It must be seen at sunrise, when the boundless plain suddenly flashes with rose-coloured light, as the first rays of the sun sparkle in the dew on the long rich grass, gently stirred by the unfailing morning breeze. . . . It must be seen, too, by moonlight when the summits of the low green grass waves are tipped with silver, and the stars in the west disappear suddenly as they touch the earth. . . . These are some of the scenes which must be witnessed and felt before the mind forms a true conception on the Red River Prairies in that unrelieved immensity which belongs to them in common with the ocean, but which, unlike the ever-changing and unstable sea, seems to promise a bountiful recompense to millions of our fellow men."

Henry Youle Hind 1858

Prairie Under Siege

Hind's testimony describes the Tallgrass Prairie of southern Manitoba just prior to its release from the Hudson's Bay Company and its opening for settlement. Millions have enjoyed the recompense which Hind so accurately predicted, but the scenes which he describes are no longer available to present or future generations.

The prognosis for survival of the remaining native grasslands in prairie Canada is poor. Range ecologist Robert Coupland recently calculated that the Canadian prairie is one of the most intensively developed landscapes in the world. In prime soil zones such as the Tallgrass Prairie zone in Manitoba, 95 percent of the land has been tilled. Agronomists have also pointed out that, given new technologies, only 5 percent of the land surface in the Canadian prairie grassland zone is non-arable.

Native prairie grasslands provide

G. Trottier

The future of our remaining prairie grasslands is in the hands of landowners and lessees.

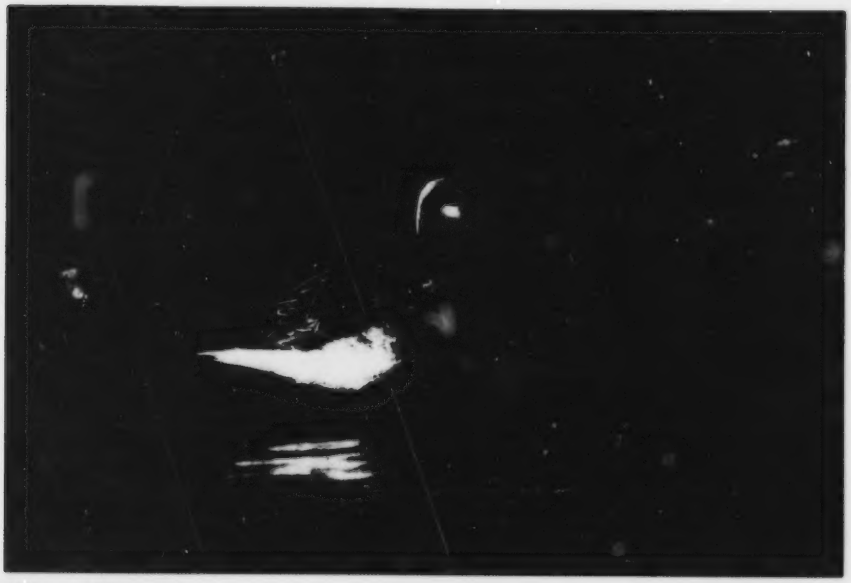
important amenities. Virtually all of the unplowed grassland is grazed by livestock, or hayed, and provides important habitat for wildlife species. Without the grasslands, Canadians would be deprived of an important source of recreation, enjoyment, applied research opportunity, and economic gain.

We cannot bring back the expanse of original prairie grassland which now supports our productive agricultural economy, but we must ensure that what remains of this precious landscape is maintained in perpetuity.

Where Do We Go From Here?

Stewardship of the remaining prairie grasslands lies with you as private landowners and public land leaseholders. In the southern prairies, 70 percent of the average cattle farm is native grassland. Along the northern fringe, this area is 48 percent. Society must recognize that, for various reasons, rural landowners and leaseholders have maintained much of our remaining grasslands, and Canadians will look to you for your dedicated leadership in grassland conservation.

With this in mind, the World Wildlife Fund, in conjunction with provincial government agencies, agricultural organizations, environmental organizations, and concerned landowners, has launched the Prairie Conservation Action Plan. This initiative is designed to motivate societal forces to ensure that not another acre of native grassland is destroyed and that what is left is used wisely for the benefit of future generations.



G. Byersbergen

Wilson's Phalarope

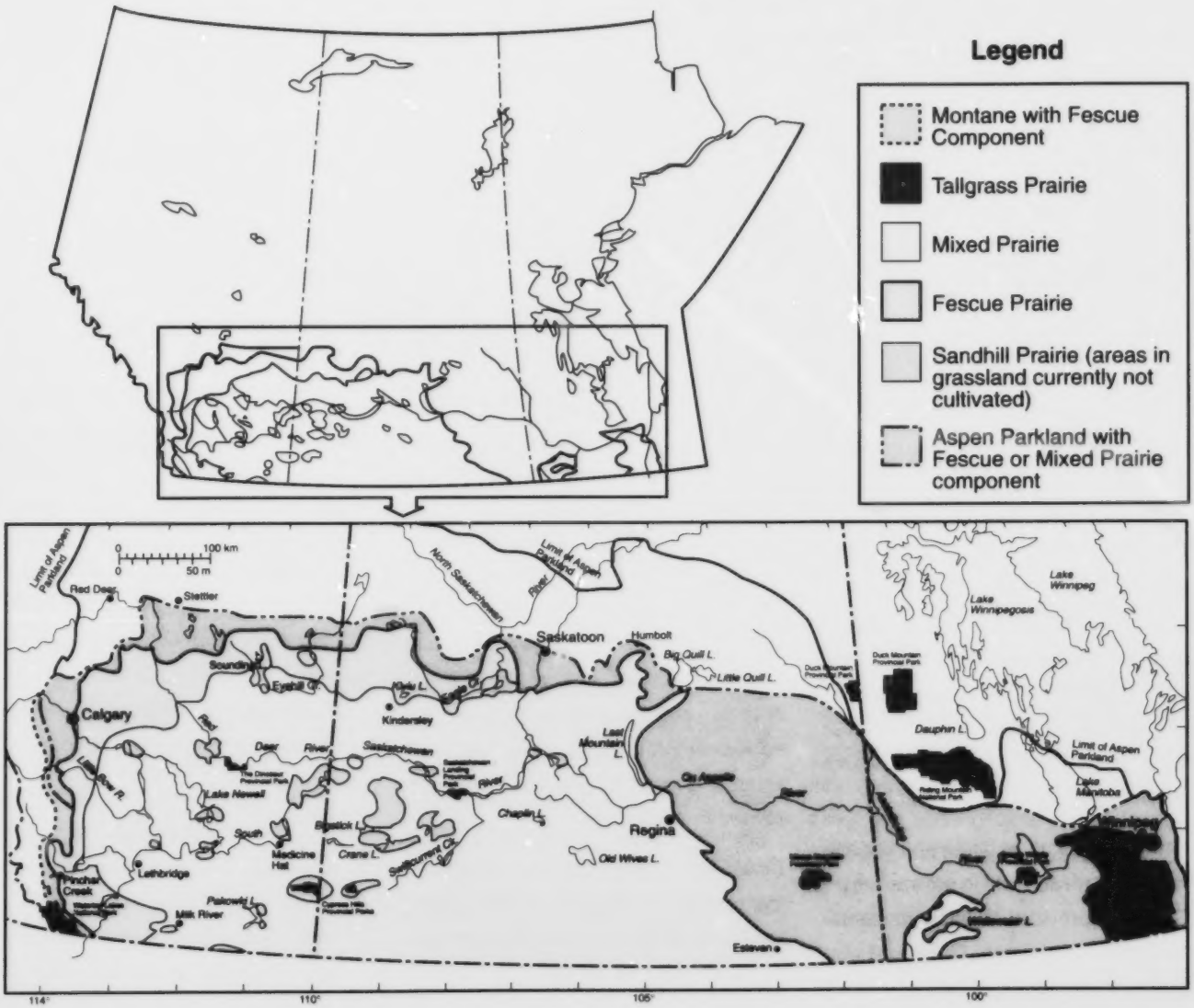
About This Guide

This guide is one of many projects being supported under the Prairie Conservation Action Plan. It has been prepared to encourage and provide ideas on how to retain native grass holdings in a productive condition both for your benefit and for the benefit of the wildlife which depends on that habitat.

The guide promotes grassland conservation on private land in several ways. Chapter 2 provides direction for identifying grassland types. Chapter 3 outlines an ecological approach to management. Chapter 4 shows how to assess grassland health so that an appropriate management direction is chosen. Chapter 5 considers management techniques such as proper livestock grazing practices, use of prescribed burning, and restoration. Sources of additional information, extension services, and incentive programs are presented in Appendices.

Finally, this guide strives to illustrate the benefits of retaining native grassland. The widely adopted idea that conversion of native grassland pays off is challenged with examples showing how these ecosystems sustain efficient, stable economic return if managed in a responsible, innovative manner.

Prairie Grasslands and Parkland



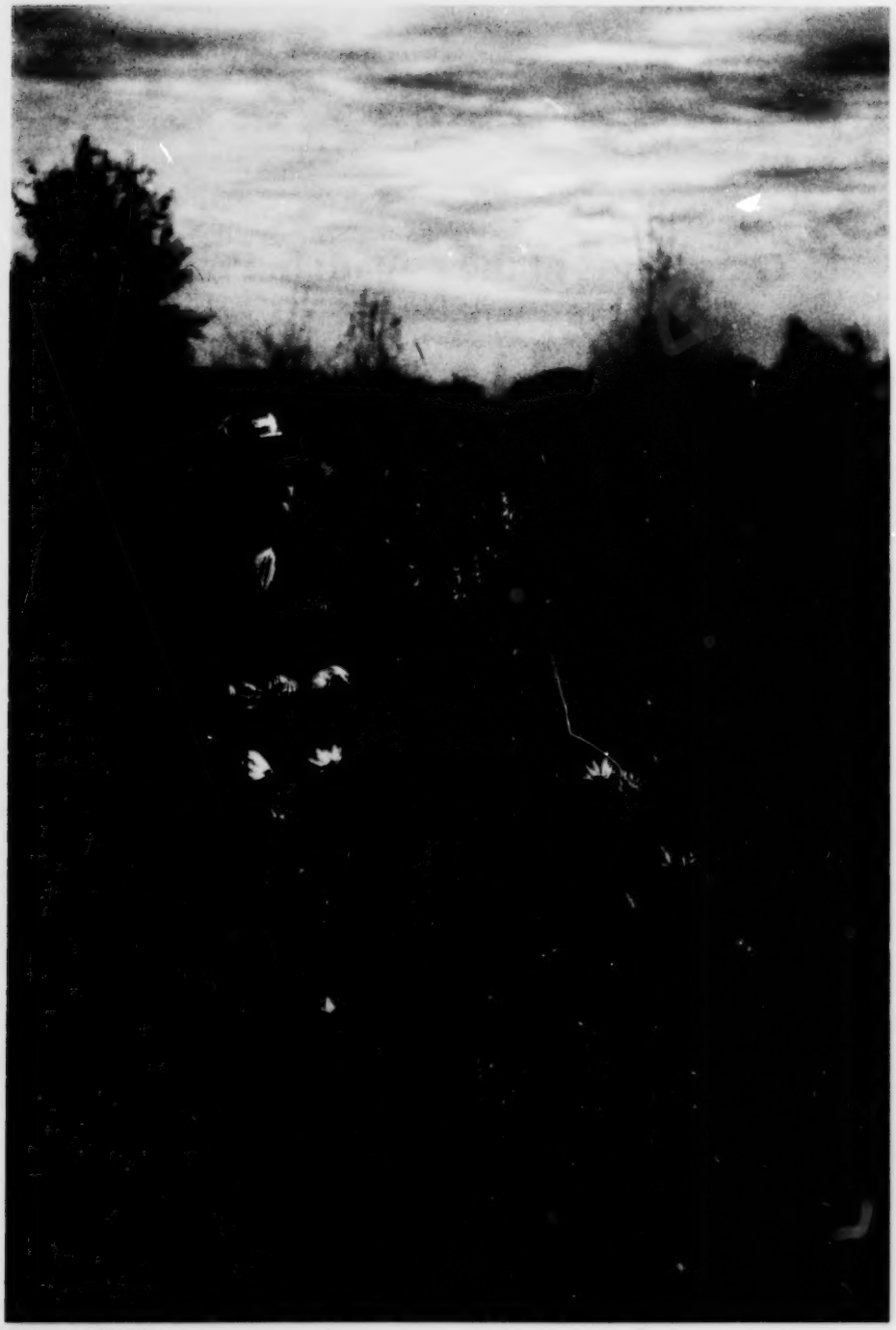
Chapter 2
Grasslands of the Canadian Prairies

The Canadian Prairie is not unlike the mosaic of human societies which have settled there. To the casual observer, all prairie looks the same, but actually it consists of grasslands with characteristics that set them apart depending on the influence of climate, topography, mineral substrate, organisms, and time.

There are three broadly-distributed grassland types in prairie Canada. Each is characterized by a unique geographic distribution and a distinct society of dominant plant species. Given the information provided in this chapter, you can identify a grassland type as easily as you can name different makes of cars.

Depending on location, there are zones of mixing between adjacent grassland types or between grass and trees where grassland meets the forest. Over time, these transition zones have shifted in extent and location due to the influence of climate, fire, grazing, and more recently, agriculture. And they will continue to shift in the future. Consequently, the boundary lines on the map opposite are largely approximate.

In pristine times, the prairie grassland vista was broken only by abrupt local changes in terrain. Ecologists call these features "complexes." The main recurring ones are wetlands, valleys (coulees), salt flats, and sandhills. Each of these areas produces unique but identifiable societies of plants and wildlife. All are particularly important in modern-day management of the grasslands because they have been unaltered by human disturbance due to their low agricultural capability. Complexes are perhaps the most important wildlife habitat left on the prairies.



D. Collicutt

Tallgrass Prairie

Tallgrass Prairie

Tallgrass Prairie takes its name from the dominant tall grasses which grow well over one metre high. This grassland, once stretching across the vast corn belt of the USA and into Canada, was described by early explorers as exceeding the height of their horses' bellies. A walk through the luxuriant, wildly-hued growth is an experience that individuals cherish forever.

The main range of Tallgrass Prairie in Canada is the 6,000 square kilometre plain centred in the Red River Valley in Manitoba. This is in addition to a 1,200 square kilometre area of sandy soils in southern Ontario between Lakes Huron, St. Claire and Erie, where Tallgrass Prairie can also be found.

But this grassland is disappearing; the rarest in Canada, all but a fraction of one percent has been converted to cropland, urban development, industrial sites, or has been invaded by forest cover. Four publicly-protected sites in Manitoba total less than 100 hectares.

Recent efforts to identify all remaining Tallgrass Prairie in Manitoba located only 81 additional hectares of prime prairie, plus 220 hectares of mostly atypical examples, all of it under private ownership. Some of these lands have recently received protection under the province's Critical Wildlife Habitat Program and the Manitoba Naturalists Society's Prairie Patron Program.

Today Tallgrass Prairie may be quite difficult to identify: under heavy grazing, Kentucky bluegrass generally overtakes the site; in the absence of fire, Aspen poplar, Western snowberry, Smooth bromegrass, and Kentucky bluegrass take over. To help in your identification, look for the key species listed below to determine whether your grassland is Tallgrass Prairie.

Typical Plants of the Tallgrass Prairie

Grasses	Forbs	Shrubs
Big Bluestem	Meadow Blazing Star	Leadplant
Little Bluestem	Culver's Root	Dwarf False Indigo
Indian Grass	Golden Alexanders	Prickly Rose
Switchgrass	Silver-leaved Psoralea	Shrubby Cinquefoil
Prairie Dropseed	Western Silvery Aster	
Sideoats Grama		

Big Bluestem: A tall, warm-season, sod-forming grass, Big bluestem is one of the most nutritious of the native grasses, flourishing under a wide range of conditions. It is excellent for wildlife, cattle forage, and beautification. Colour ranges from bluish-green in summer to reddish-brown in fall. This species begins growth in late May and produces seed in August. Growing 1-2 metres tall, it has a fibrous root system down to 4 metres. Big bluestem can be identified by its reddish stems and lower leaves, and a three-branched seed head from which its nickname, "Turkey Foot," is derived.

Indian Grass: This tall, warm-season, sod-forming grass grows on a variety of soils and provides nutritious forage. Indian grass is excellent for wildlife, cattle grazing, erosion control and beautification. It grows to a height of 2 metres. An important vegetative characteristic is the claw-like extension of the leaf sheath. It can be identified by its golden colour and the golden plume-like seed heads 8-25 centimetres long.

Switchgrass: Though most common on prairie lowlands, this tall, warm-season, sod-forming grass is also found in small, upland patches. Its ability to remain in an upright position in snow makes it an excellent wildlife plant. It is good grass for summer grazing, waterways and erosion control. Switchgrass can be identified by its open seed head and a V-shaped tuft of hair at the base of the leaf.

Little Bluestem: A medium-height, warm-season bunch grass, Little bluestem is common on prairie uplands. Highly nutritious, it makes good hay and will grow on thin, poor soils. In fall and winter its reddish-brown colour makes it one of the most beautiful grasses on the prairie. Though rarely growing taller than 1 metre, it has a dense root system which may reach 2 metres deep. It can be identified by its reddish colour, clumpy growth pattern and flattened stems.

Sideoats Grama: This medium-height, warm-season bunch grass is ideal for use with other grasses on hard-use areas such as playgrounds; Sideoats grama is a little tall for lawn use, however. An ideal grass to include in plantings for wildlife, grazing, and erosion control, it reaches a height of nearly 1 metre. It will not do well in wet sites or areas with temporary standing water. It can be identified by bumps and hairs on leaf edges and flowers that tend to hang down on one side of the stem, giving it the name Sideoats.

Leadplant: Hairy leaves and stem, along with lavender flower spikes, give this shrub a frosty, grayish appearance. The leaden colour, along with a belief that this shrubby legume grew over bodies of lead ore, gave Leadplant its name. The settlers who first ploughed the land called it "Prairie Shoestring" after the audible twang of the roots as the plough snapped through them (JoAnne Joyce, 1989).

F. Lahrman

Western White-fringed Orchid: This tall, showy orchid with flowers averaging 2.5 centimetres wide is found at only one site in Canada, in Tallgrass Prairie near Vita, Manitoba. The population consists of about 500 plants. While individuals of this long-lived perennial do not flower annually, disturbances such as burning, grazing, or periodic mowing promote flower production. Pollination is restricted to moths, notably hawk moths, the only insects with proboscises long enough to extend the full length of the long nectar tube.

Greater Prairie Chicken: No longer found in Canada, this species experienced a brief but interesting occupancy of the Canadian prairies which lasted only 50 years. Traditionally found in the moist, tall grasslands as far north as Minnesota and South Dakota, the Greater prairie chicken rapidly followed the plow northward as far as the forest fringe in Manitoba, Saskatchewan and Alberta during the late 1800s. Extensive tracts of lush grassland interspersed with cereal crops were ideal habitat for this species. By the late 1930s, however, a conversion of grassland to cropland, heavy cattle grazing, drought and harsh winters, combined with competition from pheasants and Sharp-tailed grouse virtually drove the species from Canada.

Rare Species of the Tallgrass Prairie

Plants	Animals
Western White-fringed Orchid	Greater Prairie Chicken
Small White Lady's Slipper	Plains Pocket Gopher

C. Wallis

Mixed Prairie

Mixed Prairie

The greatest expanse of North American grassland occupies the dry interior plains from Canada south to Texas. It was here, during prehistoric times, that tall and mid-grasses invading from the tropical southeast, shortgrasses from the southwest, and cool climate mid-grasses and sedges from the north intermingled, hence the name Mixed Prairie.

In Canada the Mixed Prairie is dominated by medium-height grasses including Needle and thread, Western porcupine grass, and Western and Northern wheatgrass. Short grasses and sedges including Blue grama grass, June grass, and Thread-leaf sedge form a second, lower layer of vegetation cover. These short grasses take over wherever lack of moisture limits growth or where there is overgrazing.

Over half of the remaining native grassland in prairie Canada is Mixed Prairie. It is estimated that originally there were 24 million hectares of this type in Canada; however, only 24 percent of this area remains, half of which is overgrazed.

Given the broad distribution of Mixed Prairie across the prairie provinces, there is considerable variation in the mix of characteristic dominant plants. This is particularly true along the northern transition belt or Parkland, but it also occurs where the Mixed Prairie merges with the Tallgrass Prairie in the southeast and with the Fescue Prairie to the west.

Where Fescue and Mixed grassland meet, you will find communities of Mixed grass on drier sites, usually hilltops and upper slopes, and Fescue grass at the base of slopes. Depending on soil-site conditions, you will find very distinct Mixed grass communities that are best adapted to those conditions.

Plant Communities of the Mixed Prairie

Community	Soil Zone	Soil Texture
Needle and Thread — Blue Grama	Brown, Dark Brown	Medium to coarse, droughty
Needle and Thread — Blue Grama — Wheatgrass	Brown, Dark Brown	Medium
Needle and Thread — Wheatgrass	Brown, Dark Brown	Medium
Wheatgrass — June Grass	Brown, Dark Brown	Clay (lacustrine) — moist
Blue Grama — Wheatgrass	Brown	Medium, coarse solonetzic
Western Porcupine Grass — Wheatgrass	Dark Brown, Black	Loamy, moist

Typical Plants of the Mixed Prairie

South and Central Region

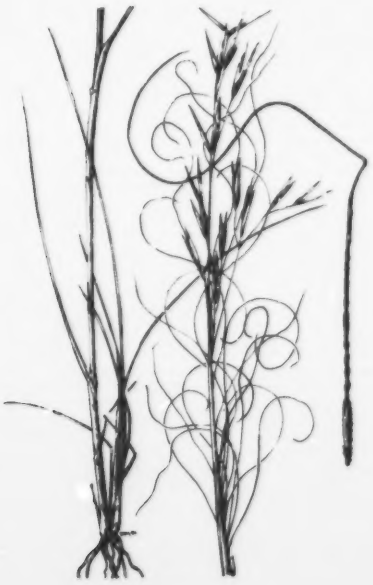
Grasses	Forbs	Shrubs
Needle and Thread	Scarlet Mallow	Pasture Sage
Western Wheatgrass	Broomweed	Silver Sage
Blue Grama Grass	Prickly-pear Cactus	Thorny Buffalo-berry
June Grass		

North and West Region

Grasses	Forbs	Shrubs
Western Porcupine Grass	Prairie Crocus	Wild Rose
Needle and Thread	American Hedysarum	Western Snowberry
Northern Wheatgrass	Golden Bean	
Slender Wheatgrass		
Plains Rough Fescue		
June Grass		

Southeastern Region

Grasses	Forbs	Shrubs
Western Porcupine Grass	White and Purple	Wild Rose
Green Needle Grass	Prairie Clovers	Western Snowberry
Western Wheatgrass	Dotted Blazingstar	
Little Bluestem	Prairie Sage	
Big Bluestem	Silver-leaf Psoralea	
June Grass	Indian Breadroot	



Needle and Thread: This very nutritious forage plant dominates throughout the drier regions of the Mixed Prairie. Each seed has an exceptionally long, soft beard which is curled; hence, it is likened to a threaded sewing needle. Needle and thread is regarded as one of the most palatable native grasses; it grows early in spring, withstands grazing well, stays green over an extended growing season, and has excellent curing properties to serve as nutritious fall and winter forage. It produces new growth in summer and fall with the advent of sufficient moisture.

Western Wheatgrass: Also referred to as "Bluejoint," this grass has several characteristics that make it useful for forage, revegetation and erosion control. It is salt tolerant, drought hardy and drainage resistant in spring run-off. A three-tiered underground system consisting of vigorous rhizomes, a mass of surface roots, and a deep root system give this plant the ability to spread rapidly and survive drought conditions. The species has been domesticated for forage planting with the "Walsh" variety most suitable for use in our southern prairie latitudes.

Blue Grama Grass: Blue grama is called "Toothbrush Grass" because of the shape of the flower head. It is palatable to livestock in early spring and late fall, but if grazed, the leaves spread close to the ground where they cannot be easily reached. Blue grama increases during dry years and on overgrazed pasture.

June Grass: Common throughout the prairie grasslands, June grass is seldom found in dense stands, but rather as single plants in mixed communities. The plants literally change their appearance depending on growth conditions, often deceiving any amateur attempting to make an identification. Although its increased abundance is generally associated with overgrazing, June grass is regarded as a palatable forage, particularly in the spring when digestible contents are as high as other good prairie grasses.

Scarlet Mallow: This beautiful little plant grows mats of stems 15-20 centimetres high with several orange-red, 5-petalled flowers on each stem. A paste made from the plant was used as a healant for sores. In days past, the native medicine man would perform a "magic" trick: he would plunge his bare arm into boiling water and not be burned (thanks to protection from Scarlet mallow paste).

Purple Prairie Clover: The seemingly iridescent rose-purple flower spikes of this plant pleasantly interrupt the green and yellow hues which dominate the prairie landscape. An important nitrogen-fixer, prairie clover had medicinal uses as well. Native peoples steeped the bruised leaves in water to treat flesh wounds.

C. Wallis

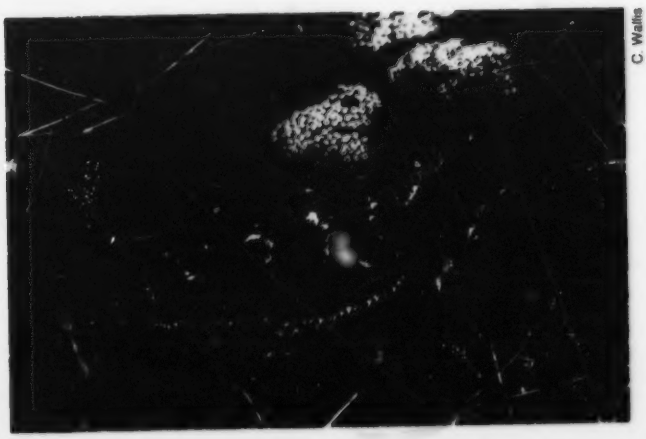
Valley complexes are some of the few natural prairie habitats remaining. Rare species are generally restricted to such areas.

Rare Species of the Mixed Prairie

Baird's Sparrow	Black-footed Ferret	Prairie False Dandelion
Burrowing Owl	Black-tailed Prairie Dog	Purshe's Milk-vetch
Ferruginous Hawk	Prairie Long-tailed Weasel	Obscure Evening Primrose
Greater Prairie Chicken	Short-horned Lizard	Spanish Bayonet
Loggerhead Shrike	Swift Fox	
Mountain Plover		

Ferruginous Hawk: This large prairie hawk is readily identified by the white splash across the belly, tail feathers and under-wing feathers. Ferruginous hawks are more specialized than others to hunt pocket gophers, ground squirrels and hares, and do this by stalking, or crouching, and waiting at the burrows. Loss of prairie habitat to cultivation which has reduced prey abundance, and fire suppression which has allowed invasion by woody plants, have led to serious declines in Ferruginous hawk numbers. Nests are generally built on the ground, preferably along crests of coulee breaks or cliffs, but in areas where this species has been forced to occupy smaller patches of suitable habitat, it uses the low trees of prairie shelterbelts in which to nest.

Loggerhead Shrike: This diminutive but aggressive predator has recently been listed as threatened in Canada. Open, short-cropped grasslands are preferred for finding and capturing principal prey including large insects, mice and even small songbirds. Shrub thickets are also essential for perching and nesting. Lacking talons with which to hold food, this bird is known for its innovative habit of impaling prey on stout thorns, sharp branches, or barbed wire for feeding purposes.



C. Wallis

Mountain Plover: This unique shorebird prefers to nest and feed in heavily-grazed native grassland. In Canada, it is an endangered species with just a few pairs known to nest in the Lost River area of southeastern Alberta. The female will often lay two clutches, one for the male to attend and one for herself, particularly when food is abundant. Black-tailed prairie dog towns are preferred habitat farther south in Montana grasslands, but searches of similar habitat in southwestern Saskatchewan have failed to locate any Mountain plovers.

Short-horned Lizard: Measuring only 10-12 centimetres long, this miniature prairie recluse is usually about in the daytime preying on insects, particularly ants. Its habit of sitting tight when danger is near and its perfect camouflage make it extremely difficult to find. When approached by an enemy, horned lizards can squirt blood by rupturing a vessel near the base of their third eyelid. A taste of this blood is thought to discourage further interest.

Black-footed Ferret: A rare inhabitant of the Great Plains of North America, this member of the weasel family, known to prey on Black-tailed prairie dogs, is listed as endangered in both Canada and the United States. The only known wild population was threatened with disease and had to be taken into captivity to save the species from extinction. These Wyoming animals are being propagated in six different locations in the western United States in an attempt to return the ferret to the wild.

Black-tailed Prairie Dogs: The only known populations in Canada are located along the Frenchman River Valley in southwestern Saskatchewan. Prairie dogs are very social animals, living in "towns" of highly-organized colonies with well-defined territories each defended by a family group. A family consists of one adult male, 4-6 adult females, and several juveniles and yearlings of both sexes. The sparsely-vegetated burrow complexes of prairie dog towns attract Burrowing Owls and Mountain Plovers. Plans for eventually reintroducing the extirpated Black-footed ferret to Canada depend on the long-term viability of the prairie dog population.

D. Wood

Fescue Prairie

Fescue Prairie

Ecologists have not been able to satisfactorily reconstruct the former extent of the Fescue Prairie. Remnants found all along the northern fringe of the prairies suggest that this was the grassland of the black soil zone through Alberta and Saskatchewan which today is an important cereal production zone.

Fescue Prairie occupies a moister environment than does the Mixed Prairie. This is evidenced by the tongues of Fescue grassland extending southward along the Alberta foothills in Montane habitats, and into the drier Mixed Prairie on the isolated hill complexes of the Milk River Ridge, Cypress Hills, Touchwood Hills and the Manitoba Escarpment.

Fescue Prairie is the prominent grassland in the Aspen Parkland, except in the adjoining areas of southeast Saskatchewan and southwestern Manitoba where Mixed Prairie shares the ground with Aspen groves. Once extending over 255,000 square kilometres in the prairie provinces, less than five percent of the original Fescue Prairie remains.

Although not nearly as threatened as the Tallgrass Prairie, Fescue Prairie is an endangered ecosystem. At 315 square kilometres, the Little Fish Lake-Hand Hills block in Alberta is the largest piece of northern Fescue grassland left.

The Fescue Prairie has greater species richness and abundance than the Mixed Prairie. Two of the most striking features of this prairie are its colour and luxuriance, the grassland in certain seasons becoming a veritable flower garden. On average, Fescue Prairie will produce twice as much forage as the most productive Mixed Prairie, but the Fescue grass can be eliminated easily if overgrazed. Abused pastures will support more Kentucky bluegrass, June grass, Oatgrass, Pasture sage and shrubs.

Typical Plants of the Fescue Prairie

Montane Regions

Grasses	Forbs	Shrubs
Rough Fescue	Prairie Smoke	Shrubby Cinquefoil
Western Porcupine Grass	Flexile Lupine	Western Snowberry
Parry's Oatgrass	Silvery Lupine	
Hooker's Oatgrass	MacKenzie's Hedysarum	
	Mountain Shootingstar	

Central and Eastern Regions

Grasses	Forbs	Shrubs
Plains Rough Fescue	Prairie Smoke	Shrubby Cinquefoil
Western Porcupine Grass	Seneca Root	Western Snowberry
Wild Oatgrass	American Hedysarum	
Hooker's Oatgrass		

Rough Fescue: The rolled leaves which are rough to the touch when pulled through the fingers provide the key to identifying this large, bunch-forming grass. Rough fescue is excellent forage of high quality, especially favoured by cattle and horses. Under proper management it will provide productive, drought-resistant range, but if overgrazed it will disappear. Scientists have recently recognized two species of Rough fescue on the Canadian prairies. The widespread Plains Rough fescue has short, underground stems enabling it to resist grazing and burning. Rough fescue which grows along the foothills lacks underground stems.

Prairie Smoke: Among the first new foliage to appear in spring, the bright green, fern-like leaves soon give way to rosy stems and delicate flowers. In clusters of three, the drooping urn-shaped flowers have showy rose-purple sepals which overshadow the inconspicuous petals. After pollination, the flowers are replaced by heads of long, plume-like seeds which give the plant the common name of "Old Man's Whiskers."

Western Porcupine Grass: This grass produces pointed seeds with long, twisted awns (beards) attached to them. The awns are thread-like structures that serve an important function. When a seed falls to the ground, the pointed end often rests on the surface of the ground. As moisture conditions change, the awn twists back and forth screwing the seed into the ground. It is anchored there by little hairs at the very tip of the seed. The seeds were reportedly tied in bundles by native peoples for use as hair brushes. Western porcupine grass is an excellent forage species and is found mainly in the eastern prairie region and on the Fescue Prairie where moisture is more abundant.

Wild Timber Oatgrass: Common over much of the Fescue Prairie, this species is considered of only fair forage value. It increases under heavy grazing because cattle prefer to eat more palatable species. Some of the flowering heads remain hidden in the leaf sheath near the plant base where they are self-fertilized and produce seed after the main flower stem has matured and broken off. Parry's oatgrass, a close relative, is the dominant oatgrass on the Alberta foothills' Fescue Prairie.

Western Snowberry: Patches of this shrub commonly called "Buckbrush" provide some of the most important cover available to nesting waterfowl and Sharp-tailed grouse. It is most often seen along coulee banks, and in the low spots on the prairie. In July, the small pink-and-white blossoms are soon replaced with clusters of small greenish-white berries that contain the seeds. These berries remain on the stems after the snow falls, becoming an important food for grouse, partridges and pheasants. Some of these seeds pass through the birds' bodies and are found in their droppings. These seeds germinate better than those which fall directly to the ground. The birds, therefore, assist in spreading the seeds into new areas, and the plant benefits.

Shrubby Cinquefoil: Rose-shaped, butter-coloured flowers and easy cultivation of this shrub lend great value to horticultural plantings. Found over much of the Fescue Prairie, this member of the rose family increases on overgrazed grassland where moisture conditions are favourable. Cinquefoil thickets provide excellent nesting cover for birds, including waterfowl. The dry, flaky bark of this species was often used by native peoples as tinder for making fires.

Seneca Root: A showy plant with several erect, leafy stems, each with a terminal spike of greenish-white flowers, this plant is renowned for its medicinal properties. The thick shallow root is collected and sold to this day through fur auction houses. Polygalic acid which is extracted from the dried ground root is used as an expectorant in the treatment of pneumonia, croup, and asthma. Native people have traditionally used it for respiratory ailments. It has also been found valuable in the treatment of rheumatism. This plant has been largely depleted by digging and overgrazing.

Hedysarum: The hedysarums belong to the pea family which is noted for its jointed seed pods and showy flowers. The pea-shaped flowers are a beautiful reddish-purple which adds greatly to the variegated carpet of herbs and grasses on the Fescue Prairie. Probably best known as an important spring food for bears, its roots were undoubtedly a staple of the now extinct Plains grizzly. The growth buds are located near the ground at the base of the plant where they are protected from grazing and low temperatures. These traits and the sweet-tasting herbage have encouraged scientists to test this species for cultivation as forage.

Piping Plover: Pebble beaches and mudflats exposed by the receding waterlines of prairie sloughs and lakes are the critical habitat for the Piping plover. Availability of this habitat is variable from year to year depending on rainfall, so it is often difficult to predict just where birds will be found nesting. Because this plover rests, feeds and raises young on the open beach flats, it is very vulnerable to disturbance from recreational activity, livestock trampling, and water-level stabilization projects which permanently flood shoreline habitat.

Rare Species of the Fescue Prairie

Plants	Animals
Crowfoot Violet	Baird's Sparrow
Wood Lily	Piping Plover
	Long-tailed Weasel (Parkland Habitat)

C. Wallis

Where available moisture is greater due to increasing latitude or elevation, grasslands give way to tree growth. These zones, where grasslands meet the forest, form a transition of grassland meadows and tree groves referred to as Parkland.

C. Wallis

Sandhills

Sandhills

Scattered across the prairies from eastern Alberta to southern Manitoba are numerous areas of sand deposits. For the most part, the sand is stabilized by grasses, shrubs and, in some cases, trees. Totalling some 10,000 square kilometres, these areas are so out-of-character with the surrounding landscape that the flora and fauna exist as obvious rarities.

These areas have limited value for agriculture, but their unique nature and abundant wildlife translate into high recreational value. Many of the prairie endangered species can be found only in these unique areas.

Sandhill complexes are dominated by Sand grass, Indian rice grass, Sand dropseed and Canada wild rye. Indian breadroot, Prairie sunflower, Blazing star, White evening primrose and Cacti can also be found. If left undisturbed, the vegetation of the lower slopes and swales (moist depressions) may stabilize with Mixed or Fescue grassland, depending on the location. Extensive cover of shrubs and scattered occurrence of trees indicate presence of available ground-water supply.

Typical Plants of the Sandhills

Grasses	Forbs	Shrubs
Sand Grass	Lance Leaved Psoralea	Creeping Juniper
Sand Dropseed	Small Lupine	Wild Rose
Canada Wild Rye	White Evening Primrose	Aspen Poplar
Indian Rice Grass	Brittle Prickly-pear Cactus	Sandbar Willow
	Skeletonweed	

Sand Grass: The only Canadian representative of the genus Calamovilfa, this grass is well adapted to growth on sand dunes, lakeshores, and open sandy forested sites. Scaly rootstocks, the bulk of which mass near the soil surface, bind the sandy soil and keep it from blowing. Sand grass is considered good forage in spring during the first month of growth, and as winter feed after it cures in autumn.

Sand Dropseed: This small bunch grass has roots which extend to a depth of 1.5 metres. The leaves have a conspicuous tuft of white hairs where the sheath and blade meet. Known as a prolific seed producer and palatable forage species, it revegetates sandy areas if not heavily grazed. When buried in the soil at a depth greater than one metre, the seeds remain viable, even after 20 years.

Indian Rice Grass: Highly sought after by southern native cultures, this plant produces an abundance of plump, oval seeds resembling the seed of common rice. A highly palatable forage for cattle and big game, the plant decreases to rarity very quickly under heavy grazing. Hence, it is not very common over most of the remaining prairies unless cattle access has been restricted.

Western Hognose Snake: Quite a large snake growing to nearly one metre, it feeds on toads, frogs, salamanders and lizards. When threatened, it flattens the neck and hisses. If the intruder is persistent, this snake will coil violently, then lie still with mouth open and tongue hanging limp in an attempt to feign death.

Great Plains Toad: This toad is a rarely-seen occupant of native grasslands near bottomlands and wetlands. Males have a peculiar vocal sac, a loose bit of skin in the throat which is inflated to a large sausage-shaped structure which bends out over the tip of the nose when the toad is calling. Sounding like a pneumatic drill, the strong call will carry up to 2 kilometres over the open prairie.

Rare Species of the Sandhills

Plants	Animals
Sand Puffs	Ord's Kangaroo Rat
Western Spiderwort	Great Plains Toad
Large-flowered Paintbrush	Western Hognose Snake
	Loggerhead Shrike
	Northern Prairie Skink

Chapter 3
Conserving Grasslands — Management Considerations

Recognizing the Ecological System

Conserving or maintaining native grasslands is made easier by understanding the cause-effect relationships between environmental forces and the plants and animals which make up the grassland. Grasslands are complex systems which, like organisms, are shaped by the forces of their environment. Likewise, they adapt whenever these forces change.

Grasslands consist of soil, plants and animals, and their appearance as well as their productivity will vary from place to place depending on these forces:

- Climate
- Terrain (including soil substrate)
- Organisms (kinds and numbers of plants and animals)
- Time

Grassland appearance is constantly changing as organisms come and go, multiply, or die, depending on their ability to survive with the prevailing environmental forces.

By their use of grasslands, humans too, cause changes there. The grasslands' ability to survive, perpetuate and provide benefits to society will depend on how wisely we use them.

"Distinguishing cause-effect relationships from grassland management problems is essential before successful management strategies can be

Cause-Effect Relationships in the Grassland Complex

Use	Cause	Effect
grazing	overgrazing	weedy, low production
grazing	proper grazing	vigorous, high production

implemented" (Pyle and Johnson, eds. *Managing Saskatchewan Rangeland).* Rather than treating the results of poor management, grassland users need to identify and correct the actual problem. For example, to counter declining grass production, farmers sometimes rely on repeated use of fertilizers, herbicides, mowing, or perhaps breaking the native sod and reseeding, when the real cause for low production is overgrazing.

Essentially, conservation is wise use. The aim of conservation is "to insure a continuous yield of plants, animals and materials by establishing a balanced cycle of harvest and renewal" (Odum, E.P. *Fundamentals of Ecology).* The use of grasslands should not be an issue; rather the issue is whether or not the uses are wisely applied so that grasslands are maintained in a healthy state.

How to Prepare a Management Plan

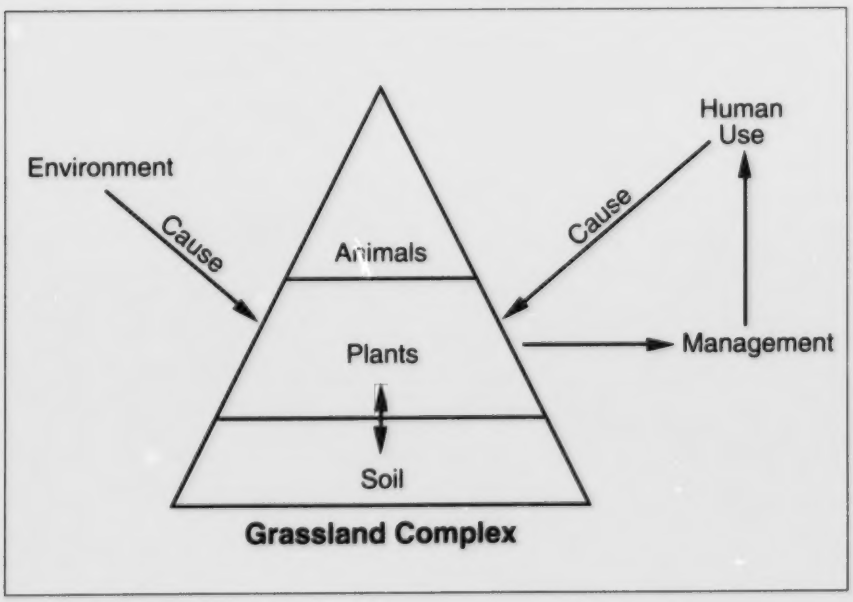
A management plan spells out two things: long-term goals for the future and strategies for achieving those goals. The process involves identifying the problem/issue to be examined, stating the goals related to that issue, identifying the actions and resources needed to address the issue, and developing an initial plan for the management response. These are the steps to follow:

Step 1. State Objectives

It is important to determine the specific objectives for any management plan; such objectives will have a direct bearing on the character and quality of the vegetation you will want to attain through management. The key operating principle should be to sustain maximum vegetation productivity and community diversity, and to prevent exploitation, destruction and neglect.

Specific objectives will depend on whether you are a landowner, a lessee of private or Crown lands, a resource manager of Crown lands, or a representative of a resource company with right-of-entry. Your objectives will also be influenced by whether or not you are deriving a living from the grassland. Naturally, your plan will also depend on the present condition of the grassland vegetation. Here are just a few plans of the many that are possible:

- Improve grassland condition to provide better grazing
- Increase grazing capacity through range improvement



Grassland Complex

- Produce native seed as a cash crop
- Enhance wildlife habitat for game species or endangered species
- Restore pristine ecological processes, plants and animals to serve as a natural area
- Restore and revegetate surface disturbance to predisturbed condition as required by reclamation regulations

Step 2. Do a Biophysical Inventory

Take stock of what you have to work with so that you can correctly determine what and how much change must be achieved, how to get the job done, and how much it is going to cost. The following considerations are necessary:

Characterize the vegetation

The first question to consider is whether or not the grassland in question is native, i.e. never been ploughed and cultivated. Some lands that were ploughed only once and not cultivated may have recovered naturally depending on the size of the disturbed area and how long it has been since the breaking took place.

Cultivated areas such as seeded hayland and cropland which have been idle for many years can be distinguished from native grassland by the very low number of native grass and forb species on the site. Usually in a native grassland you will have no trouble finding 15-20 native grass species of which 3-5 will be the dominant cover. (An unploughed grassland will support in excess of 100 plant species over an area of just a few acres.) In contrast, cultivated areas will have few species including a dominant grass cover of just one or two introduced species. A long history of overgrazing can kill the majority of native species, leaving bare ground suitable for invasion by weedy, introduced perennial grasses. Such areas may be indistinguishable from idle cultivated areas, however.

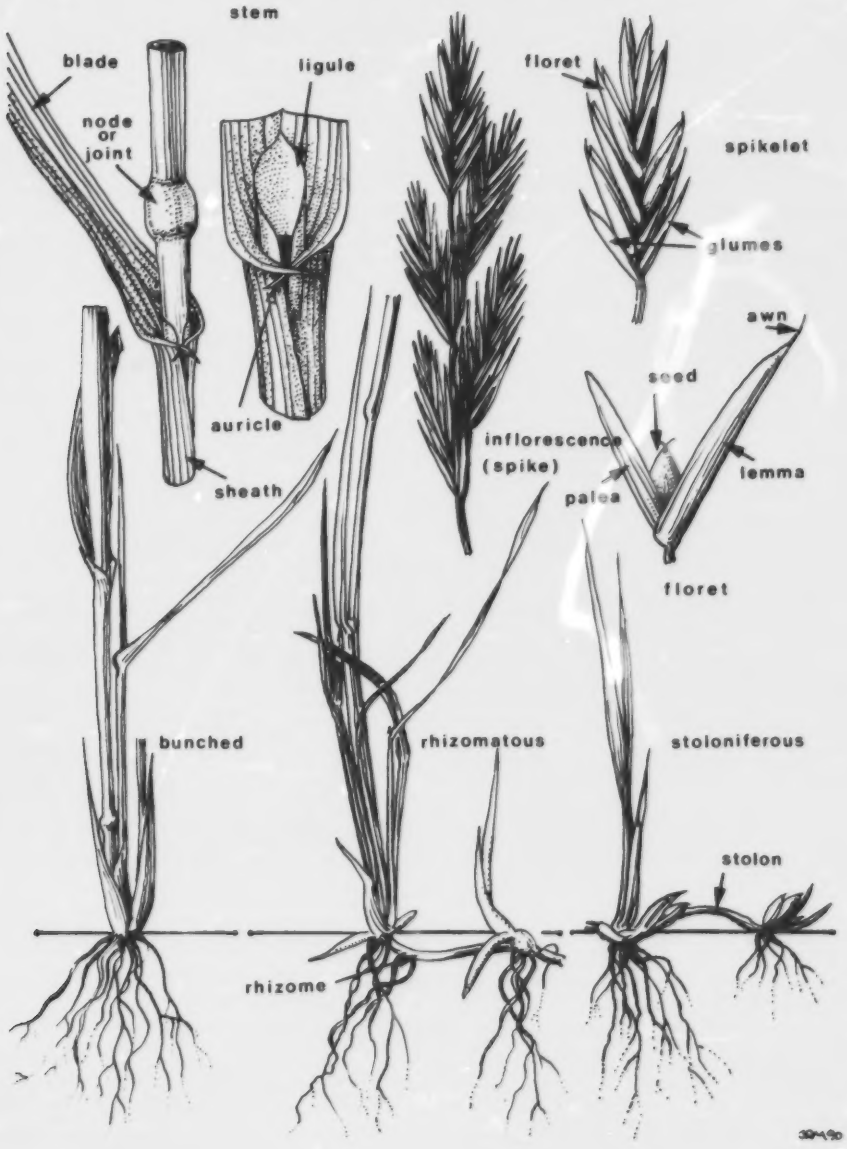
Next, identify the grassland type (see Chapter 2) and range sites which make up your grassland (plant identification skills or expert assistance will be required).

All future decisions involve the present vegetation composition, structure, and condition (Chapter 4) and how they relate to the desired vegetation defined in the management objectives (Romo and Driver, *A Goal Oriented Model For Management of Vegetation in Natural Areas.* University of Saskatchewan, Saskatoon. S7N 0W0).

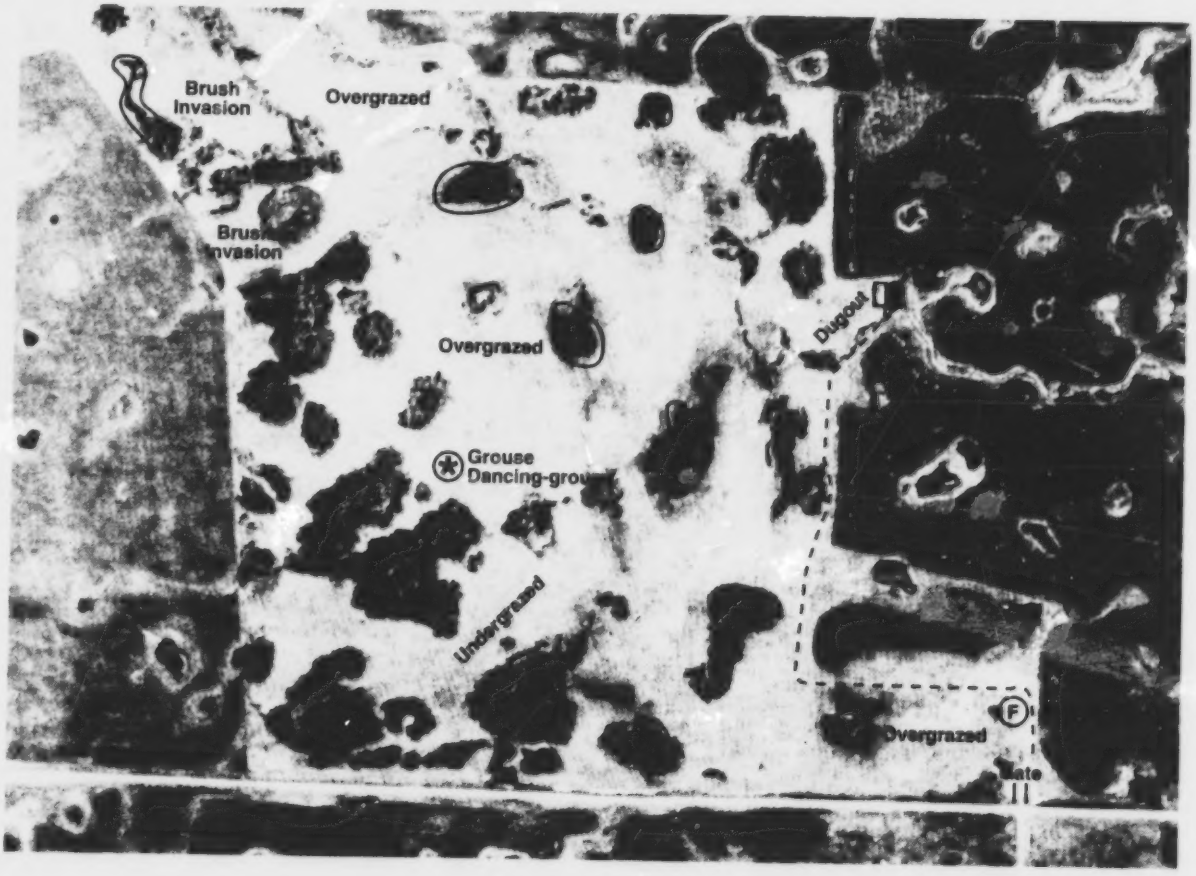
Range plant groups

Study of plant groups will assist you with plant identification.

Parts of grass plants



Grass species are identified by differences in their parts.



An air photograph or a map will help you plot all the pertinent information you will need to plan your project. Management problems such as overgrazing and undergrazed (non-use) areas, and brush invasion can be indicated (see page 55 for a management plan for this pasture).

Legend

Trail - - - - - -
Wetland (W)
Mineral Feeders (F)

Vegetation: Parkland (w Mixed Prairie)
Management: Continuous grazing; 15 May to 30 September

Map the Resources on the Management Unit

- Grassland and other vegetation-community boundaries (range types)
- Differences in soils (sandy, clay pan, solonetzic, saline)
- Topography (steep hills, ravines)
- Wetlands and other waterbodies
- Unique plants (rare, poisonous)
- Wildlife (dens, burrow complexes, foraging areas, breeding grounds, trails, rest sites)
- Developments (fences, corrals, roads, stock water, mineral feeders)
- Stocking rates if grazed
- Management problem sites (overgrazed, brush invasion)

Step 3. Define Management Actions and Tools

This is the point where inventory information is evaluated and the courses of action are detailed. Adjustments to the present use pattern should be listed along with timing of particular actions to be implemented.

Taking the time to write down all aspects of your project will allow you to evaluate feasibility in terms of financing, technical assistance, available time and labour, and responsibilities for getting the job done. Use of a worksheet will help to ensure no details are left out or critical steps forgotten once the project is underway. Site developments can be diagrammed on an overlay which you can place over the original resource inventory map or photo (see page 55).

Management Issue / Action Plan Worksheet

The management issue (problem) to be examined here is *Aspen encroachment onto native Fescue grassland, declining forage production for cattle.*

The long-term goal guiding my response to this issue is *Maintain 110 acres of grassland free of Aspen suckers to sustain efficient cattle grazing.*

The short-term goal to be attained thru this action plan is *Eliminate Aspen suckering over 25 acres of grassland bordering 4 Aspen groves.*

Additional information needed is *Technical guidance on when to burn, burning regulations and equipment required, how to identify grass species.*

Person(s) to secure that information *Tom*

That information will be obtained by *December 15, 1991*

Resources Needed to Attain the Short-Term Goal

Total Resources Required (dollars, labour, advice, equip...)	**Resources now Available** (what resource, who will supply, when supplied)	**Other Resources** (resource, source, timing)
Field inspection – Ag Rep – 1 day	*Modify spray tank for fire water*	
Drip torch – 1, Rakes – 2,	*pumping – $150 – March 91*	
Flappers – 3, March 91	*3 neighbors to help with burning*	
Cost – Equipment – $150		

Action to be taken is

Person Responsible for Action or Activity	**Nature of the Action or Activity**	**Expected Completion Date**
Tom	*Field inspection, Technical info*	*Sept. 15, 90*
Self	*Burn permits, advise neighbors*	*April 15, 91*
Fire boss (Tom)	*Organize crew, set fire guards*	*May 10, 91*

Form Courtesy of Paul Gessaman, Professor of Agricultural Economics, University of Nebraska, Lincoln.

Step 4. Monitor Results and Evaluate

The effectiveness of proposed management practices must be evaluated. This should be done by monitoring the trend in grassland condition and progress toward the original objectives. Photographs can be a helpful way to measure results of vegetation management.

Aspects like vegetation change and wildlife response to management often take several years to become evident, so you will need to be patient with the project. Also remember that objectives may change. Hence, further adjustments to the plan may be required.

The following questions are important for monitoring your action plan:

- Have my objectives been achieved?
- Am I seeing positive ecological changes on my land:
  - Has production been increased?
  - Is my beef herd healthier?
  - Is the grazing season longer and more stable?
  - Have desirable forage grasses increased?
  - Is there more wildlife using the area?
  - Have endangered species settled and reproduced?
- Has my quality of life improved?

(Adapted from Pyle and Johnson, eds. *Managing Saskatchewan Rangeland,* 1990.)

You will need to develop an effective monitoring system. Such a system consists of gathering before-and-after treatment information; otherwise, you will find it difficult to answer the above questions. Keep track of all costs incurred so that you can see whether the return on your investment was recovered through increased gross returns and profit margins.

Chapter 4
Assessing Grassland Condition

The term "condition" describes the present species composition and vigor of the plant community compared to its potential. Condition refers to the health of the grassland and long-term productivity, but not to annual production which is largely an influence of current precipitation and temperatures.

Once determined, the condition of your grassland will have a direct bearing on the management objectives you wish to establish and the means you choose to achieve them.

The grassland condition concept has been developed to account for the impact of grazing, although other types of disturbances can influence condition in similar ways. For example, fires, trampling or hay cutting can reduce soil moisture and change species composition.

Grazing and other forms of disturbance have a direct bearing on grassland potential and, hence, on condition. Even a prolonged drought will change the species composition of a grassland by favouring less-productive, drought-resistant species. A site in poor condition will support fewer cattle and/or different species of wildlife, and produce fewer pounds of beef than can be supported on good-to-excellent sites. As well, sites in poor condition cannot withstand climatic variation such as drought. Generally poor sites have lost a good proportion of the more productive, desirable plant species which, in turn, have been replaced with less desirable, often poorer-producing invaders.

The key to maintaining or restoring near pristine condition is to manage for a proper balance between use of, and rest for, plants.

G. Trottier

Repeated, untimely disturbance of any kind will favor certain plant species over others and reduce grass vigor. The Fescue grassland on the left was burned 3 times in 8 years compared to the right which was burned 5 times. Note the shorter, less vigorous growth and unprotected ground on the right. Ground-nesting birds and small mammals were more abundant in the less frequently burned area.

Grassland plants have been classified depending on whether they become more abundant or less abundant in a community when there is disturbance or rest.

Decreasers:
These are desirable forage plants most liked and sought after by livestock. Repeated, excessive disturbance (defoliation) causes them to decrease in abundance and vigor.

Increasers:
These are plants not as readily eaten by livestock, or affected by other disturbances. Initially, they increase in abundance following disturbance, then decline if excessive disturbance continues.

Invaders:
These are largely weeds or introduced exotics which appear and increase if excessive disturbance weakens and kills increaser/decreaser species. Invaders are very resistant to disturbance and are usually less productive.

Proper Use:
This is the balanced use and the resting of the plant community which will maintain increasers and decreasers in balance, and generally discourage invaders.

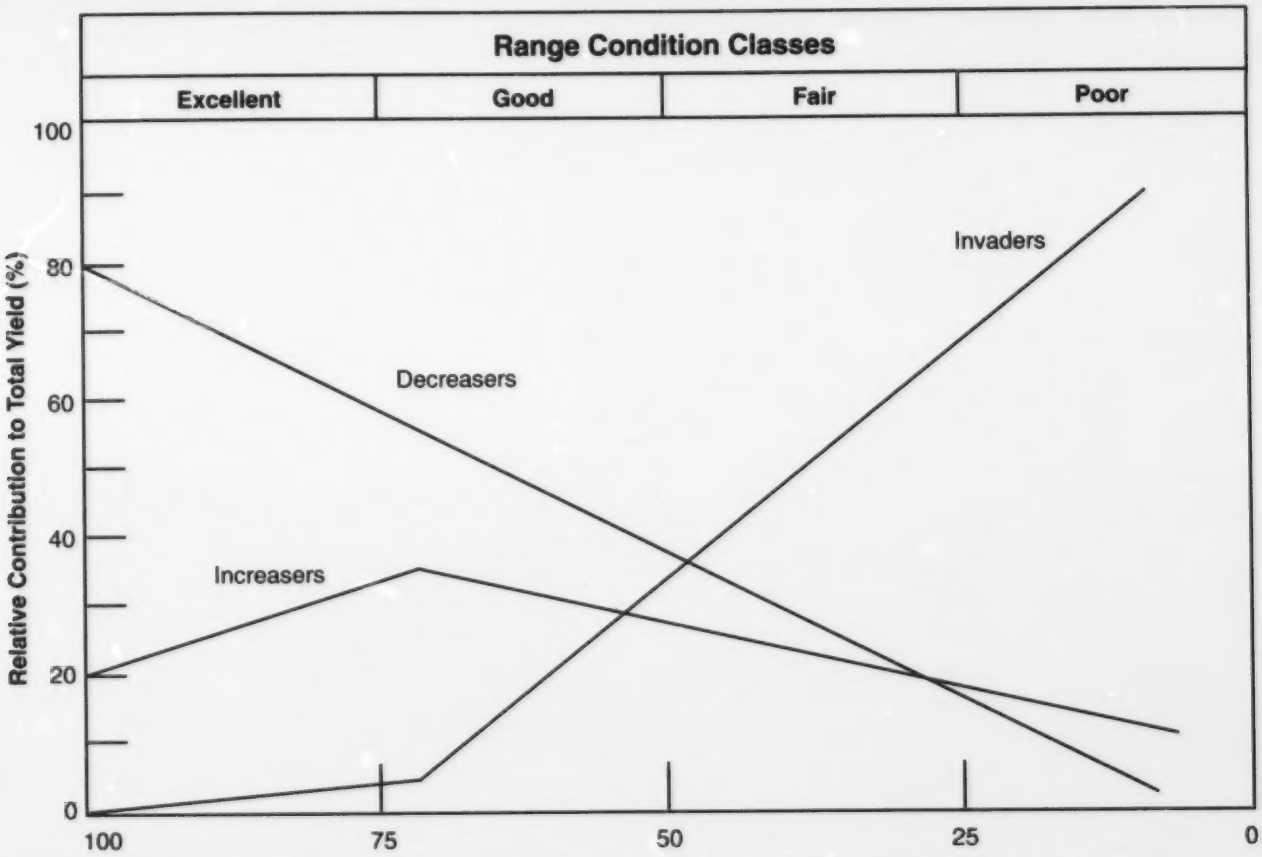
To rate condition of grassland, follow these steps:

1. Identify and roughly estimate the relative cover of the dominant grass and forb species in each range site or plant community.
2. Refer to the species lists in the published Range Guide for your area to see which species are typically decreasers, increasers, or invaders, and what proportion these occupy in the potential or climax community.
3. Compare the estimated proportions of these three groups in your range sites to the potential or climax community and calculate range condition.

Example:

Species	Proportion of cover (%) In site	In climax	Proportion of site cover reflected in the climax
Increasers			
Big bluestem	1	45	1
Porcupine grass	5	40	5
Decreasers			
Little bluestem	10	5	5
June grass	7	5	5
Sideoats grama	7	5	5
Invaders			
Kentucky bluegrass	50	0	0
Dandelion	20	0	0
Total (Condition score)			**21**

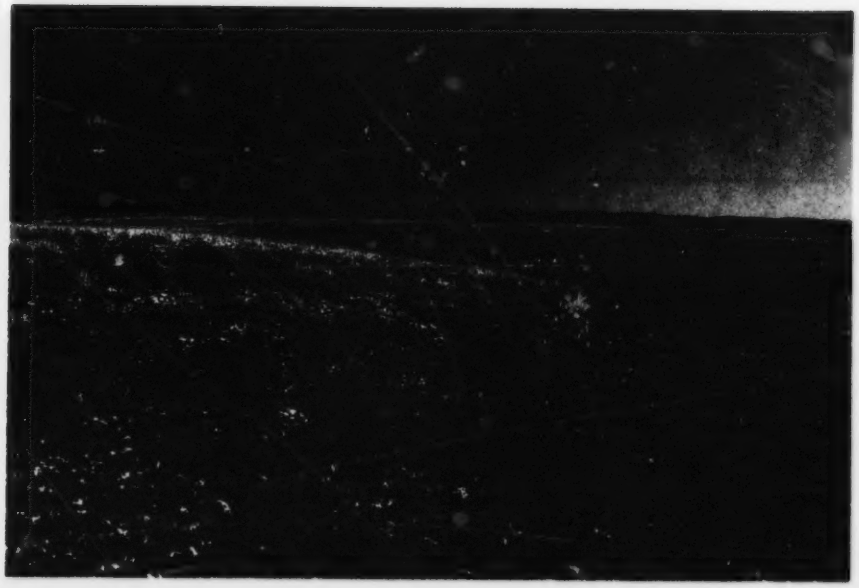
Condition Score	Condition Rating
0-25	Poor
25-50	Fair
50-75	Good
75-100	Excellent



As range condition decreases, the proportion of decreaser plant species in the community declines, while the invaders increase. Increaser species become more abundant under light to moderate grazing pressure, but they are grazed out of overgrazed pasture in poor condition (Abougouendia and Copeland 1985).

J. Romo

Mixed Prairie in excellent condition. Healthy, complete plant cover is productive and soil moisture is retained.



J. Romo

Mixed Prairie in fair condition with numerous forbs.

J. Romo

Mixed Prairie in poor condition. Forage yield is low due to moisture loss, soil erosion, extensive weed patches, and lack of plant cover.

Chapter 5
Choosing the Appropriate Management Tools

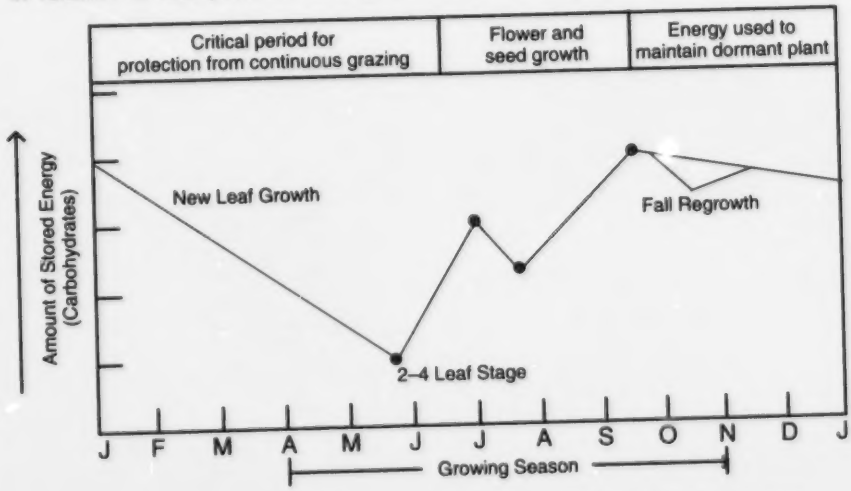
Grassland management involves manipulating the vegetation through disturbance to achieve predetermined goals. The tools of disturbance are varied so you will need to pick those most appropriate to achieve the particular objectives you have set for conservation of your grassland.

This chapter describes the primary tools of disturbance, the context in which you can apply them, and what overall effect you can expect depending on which is used and how it is applied.

Rest — When and How Much

Grasslands were shaped by fire, drought, and grazing by mammals and insects; however, there were seasonal periods of rest when plants had a chance to recover from the effects of defoliation, top kill, and interrupted growth.

A key principle of grassland management is ensuring a proper balance of rest and disturbance. Vegetation can be manipulated by varying the rate, intensity and frequency of disturbance in relation to rest periods. All organisms, including humans, are alike in that they cannot sustain a constant demand on their energy. Without sufficient, timely rest to replenish energy reserves, their ability to survive and reproduce diminishes.


Critical period for protection from continuous grazing
Flower and seed growth
Energy used to maintain dormant plant
Amount of Stored Energy (Carbohydrates)
New Leaf Growth
2–4 Leaf Stage
Fall Regrowth
J F M A M J J A S O N D J
Growing Season

Typical stored energy cycle for a cool-season prairie grass. Any disturbance which severely reduces new leaf growth will prevent the plant from storing energy and it will eventually die. This knowledge will enable you to protect desirable plants and use disturbance to eliminate undesirables.

G. Trottier

A fenced enclosure in Fescue grassland. Protection from grazing for 20 years allowed Aspen invasion and the build-up of dead plant material that may include forbs. Central portions of some of the Fescue-basal crowns are dead, suggesting possible fungal infection.

Long-term protection from disturbance may be unhealthy. For some types of grassland, elimination of defoliation (grazing) or fire will initiate plant successional trends that over the long-term are characterized by loss of species diversity and lower growth potential. Depending on the climatic zone, these grassland types will be replaced by shrub and tree cover. Therefore, knowing where and when to implement rest is a key management challenge.

Researchers do not have all the answers on how to manage rest, be it short-term for individual plants, or long-term to improve grassland condition. What they have determined is that although controls over degree and timing of disturbance are necessary to restore plant and/or grassland health, there is a point at which the absence of disturbance causes a build-up of organic matter on the ground surface, choking out plants and cooling the soil. This deprives soil micro-organisms of organic matter required for nutrient cycling. Plant productivity declines and species diversity may be affected. Wildlife species dependent on open grassland will be displaced.

Remember that some defoliation of grassland plants is desirable and will, in fact, stimulate greater growth, just as pruning our garden plants and shrubs improves their health.

Livestock Grazing

Management Considerations

Most native grassland remaining in Prairie Canada supports livestock and will continue to do so. Unlike many other crops, however, grass cannot be totally harvested annually. With proper management, native grassland is a definite asset to the livestock producer over the long-term, and provides the following desirable benefits compared with pastures seeded to introduced perennial grass:

- It provides excellent summer and fall forage because of growth and curing characteristics
- It produces high quality forage
- There are no establishment costs; under proper use it does not require fertilization or reseeding to maintain stand vigor
- It is more resistant to disease, severe climatic disturbance, and continuous grazing
- Soil fertility and greater root mass are maintained

Properly managed grazing is compatible with, and is a tool to be used for maintaining native grassland composition in excellent condition. Grazing does not have to be eliminated in order to recover grasslands in poor condition; recovery can be achieved by reducing the stocking rate and altering the period of grazing.

Practicing a few simple principles of proper management can stabilize financial return, lower risks, and simplify management:

- Balance the stocking rate with what the range can support in its present condition
- Graze at the right time of the year to give native grasses the chance to complete their growth cycle
- Distribute grazing evenly by moving mineral (salt) feeders, providing accessible stock water, and by herding
- Provide alternative pasture or feeding in the spring to delay grazing of native grassland
- Control grazing to leave enough foliage on forage plants so that they may regrow and store energy for future growth
- Avoid continuous close cropping, particularly in the spring and in the fall

Agriculture Canada

Greenhouse sods of Rough fescue clipped to simulate no grazing, moderate grazing, heavy grazing and very heavy grazing. Root volume and depth decrease when there is insufficient leaf area to produce food reserves for root growth. Grass roots stop growing after defoliation and will not grow until the grazed leaf material is replaced. Continuously cropped plants become less drought tolerant and eventually die. Controlled grazing ensures that grazed plants have a chance to rest and grow before they are re-grazed.

C. Wallis

Proper grazing maintains healthy grasslands. Grazing is a selective disturbance force which affects grassland vegetation in three ways: defoliation, trampling, and nutrient cycling. Light to moderate grazing controls build-up of plant organic matter. Trampling helps break down dead plant material and exposes soil to serve as a seed bed. Consumed plant matter is returned to the system as waste for soil nutrient cycling.

Grazing Systems — A Matter of Choice

Grazing systems are merely schedules indicating where and when livestock are to graze. They go beyond the traditional low-cost method of continuous grazing where cattle are allowed to graze the same field throughout the grazing season every year. Although they are implemented to increase farm productivity, they also involve greater input costs in terms of time, fencing, and associated developments. Their most important contribution to grazing management is that they help control where cattle graze, when the forage plants are grazed, and when they are allowed to recover from defoliation.

However, grazing systems cannot be expected to improve productivity of overgrazed pastures in poor condition unless stocking rates and the grazing season are adjusted in accordance with the present condition. When the condition has improved, your grazing system will carry more livestock.

Grazing systems are designed to do the following:

- Maintain or improve grassland condition
- Reduce animal selectivity and forage
- Improve the distribution of grazing
- Improve livestock production and performance
- Improve the ease and flexibility of management

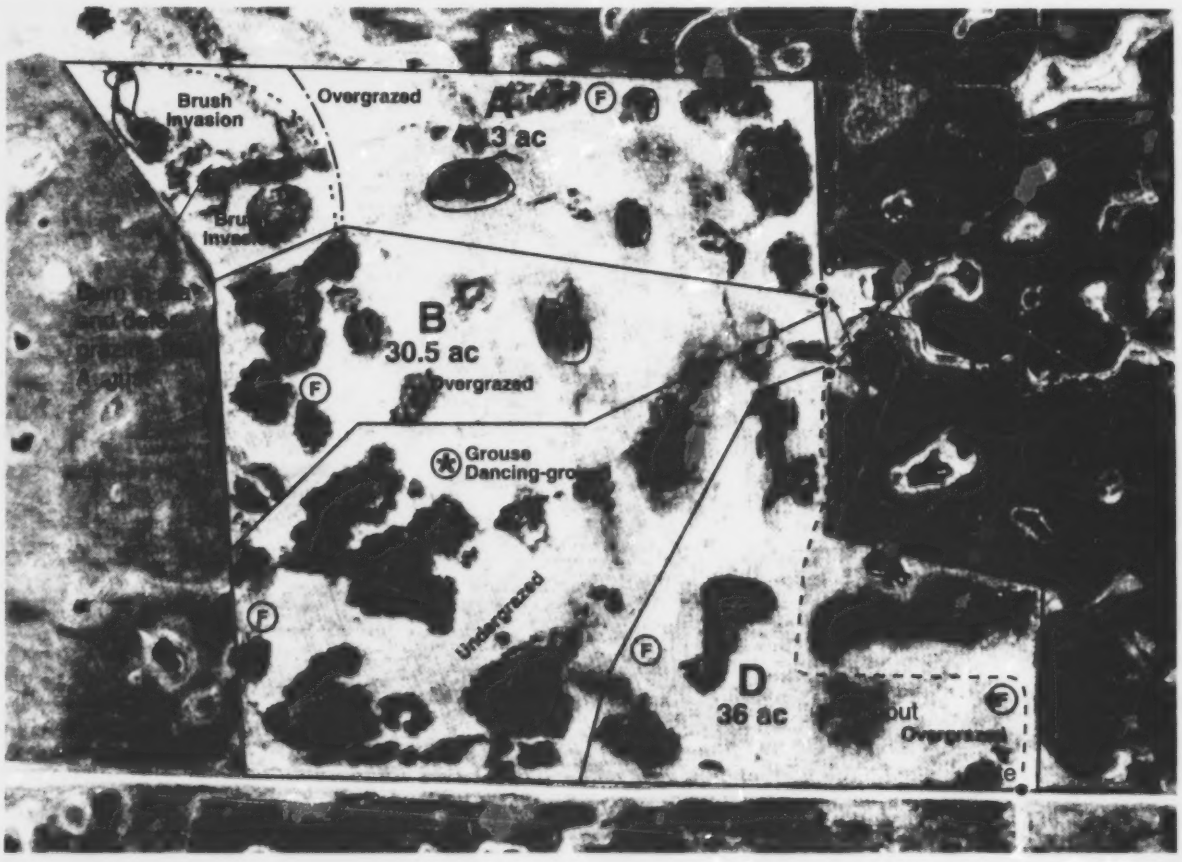
Cattle naturally favour certain plants and areas of a field which they will graze and regraze. If free choice prevails, a patchwork of over and undergrazed areas develops. Without proper rest between grazing periods, the desirable forage plants in the grazed patches die and are replaced with less desirable, often shallow-rooting, weedy plants. Over time, range carrying capacity declines.

With moderate to light stocking, continuous grazing can be practised effectively as a system in the flat, drier grasslands of the Mixed Prairie where snow is not a factor limiting winter grazing.* This system is best practiced on the extensive ranching operations of the Mixed Prairie region where the costs of more intensive grazing systems would be prohibitive and grazing can be distributed. Good distribution of grazing which allows plants adequate rest is possible on these larger range units by the following methods:

- Water developments
- Moving mineral (salt) feeding stations
- Herding livestock
- Establishing winter and summer ranges

There are numerous grazing systems applicable to conditions on the Canadian prairies, however there is no best system. Because each farm or ranch unit is unique, operators will have to choose the system which meets management goals, the financial situation, and the land operated.* A district agriculture extension specialist will help design a system to meet any particular situation.

*Adams, B.W., G. Ehlert, and A. Robinson. *Grazing systems for public grazing lands. Alberta Range Notes,* Issue #10, Alberta Public Lands Branch, Edmonton.



A twice-over deferred rotation pasture project in southeastern Saskatchewan. Cross-fencing is solar-powered electric. Beginning in June each field is grazed in rotation for about 10 days, then each field is grazed a second time for 20 days. As a result, rest periods following grazing vary from 30 to 60 days. The 62 hectare pasture carries 32 cow/calf pairs for 120 days and about 30-40 percent of the forage produced is used on average. Overgrazed areas have recovered.

Legend

Fence ———
Temporary Electric Fence —·—·—
Trail - - - - - -
Wetland (W)
Mineral Feeders (F)
Fire Guard ·· ·· ·· ··

Vegetation: Parkland (w Mixed Prairie)
Management: Rotation grazing;
1 June to 28 September

Grazing and Wildlife

The height, density, and species mix of the grassland vegetation determine which species of wildlife will be able to live in an area. Some species require dense, ungrazed to lightly-grazed grassland cover, while others will be found only if open, heavily-grazed patches are available. Some species will nest only in grass cover, others only in shrub and tree patches. Therefore, it is inaccurate to generalize that certain grazing practices are better for wildlife than others. Range improvements or practices which alter the relative abundance of grass, shrub, and tree patches generally determine which wildlife species will be favoured over others. Therefore, what is good for certain species of wildlife may not be in the best interest of the stock producer's pocketbook. (See Appendix 6 for information on the habitat preferences of typical prairie wildlife species.)

As a general rule, poor grazing practices adversely affect not only wildlife but also the vegetation and soil. You should not assume that because overgrazed patches of grassland will benefit certain wildlife species that this is justification for overstocking a grassland to gain greater short-term profits.

Proven Grazing Systems for the Canadian Prairie Region

Grazing System	Suitability
Continuous grazing	Mixed Prairie, extensive acreages
Twice-over, deferred rotation	Mixed and Tallgrass Prairie regions, for acreages up to a section
Deferred rotation	All prairie regions, for larger acreages
Rest rotation	Extensive acreages in the Mixed and Fescue Prairie; recommended for recovering range in poor condition
Complementary grazing and Complementary rotation	All prairie regions where a combination of native and tame grass pasture is available

Maximum grass growth on Montane Fescue Prairie is achieved by delaying grazing until after the growing season. Fescue growth decreases if grazed more than once during the growing season.

Forage Use and Livestock Gain with Various Grazing Systems tested at the Central Grasslands Research Station, Stockton, North Dakota, 1982-86

	Mean Stock Rate (Animals/Section)	Mean Forage Use	Calves AG/ha (kg)
Twice over rotation	135 cow/calf units	50.3	60.2
Continuous grazing	90 cow/calf units	58.2	39.6
Short duration rotation	135 cow/calf units	53.8	56.2

AG/ha = average gain per hectare
Source: Wm. Barker, North Dakota State University, Fargo.
Under proper stocking, continuous grazing cannot sustain the level of beef production that other grazing systems attain given proper forage use.

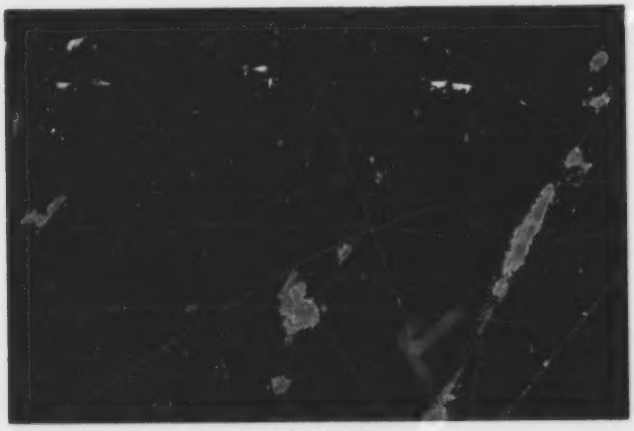
Waterfowl Nesting Data for Grazing Systems at the Central Grasslands Research Station, Stockton, North Dakota

	Number of nests found per 100 acres	Nest success %	Successful nests per 100 acres
Twice-over rotation	13.2	34.7	6.6
Short duration rotation	13.0	25.6	5.3
Continuous grazing	9.6	26.6	4.6
Ungrazed	18.7	11.3	5.9

Source: K. Sedivek, North Dakota State University, Fargo.
Research has shown that more ducklings may be produced in grazed native grasslands than in adjacent idle grassland. Some grazing systems appear to be better for ducks than continuous grazing.

G. Trottier

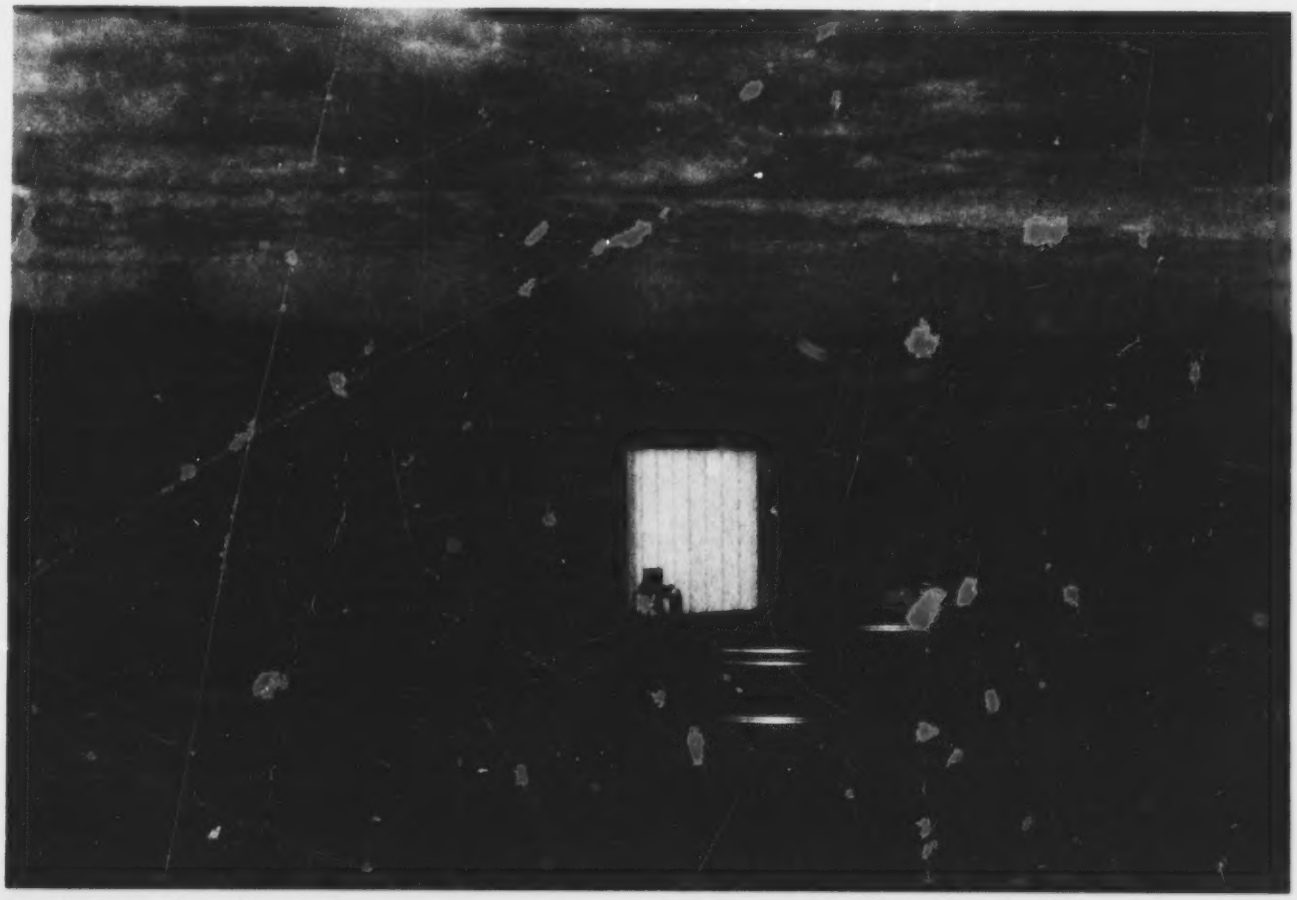
Ground-nesting birds, including ducks, require sufficient vegetation cover to protect their nests from predators and severe weather.



G. Trottier

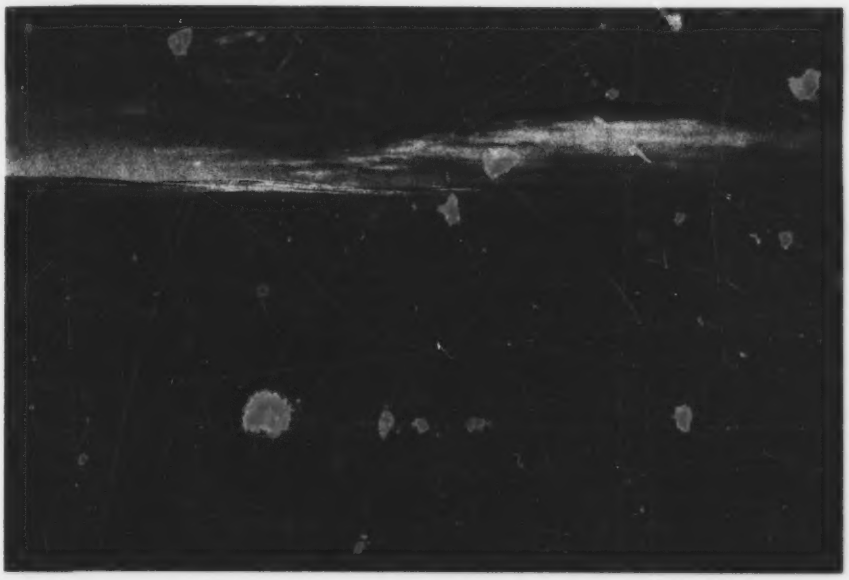
Overgrazed pastures attract few birds.

Here are some grazing management considerations which can generally benefit wildlife while enhancing the overall efficiency of livestock operations.



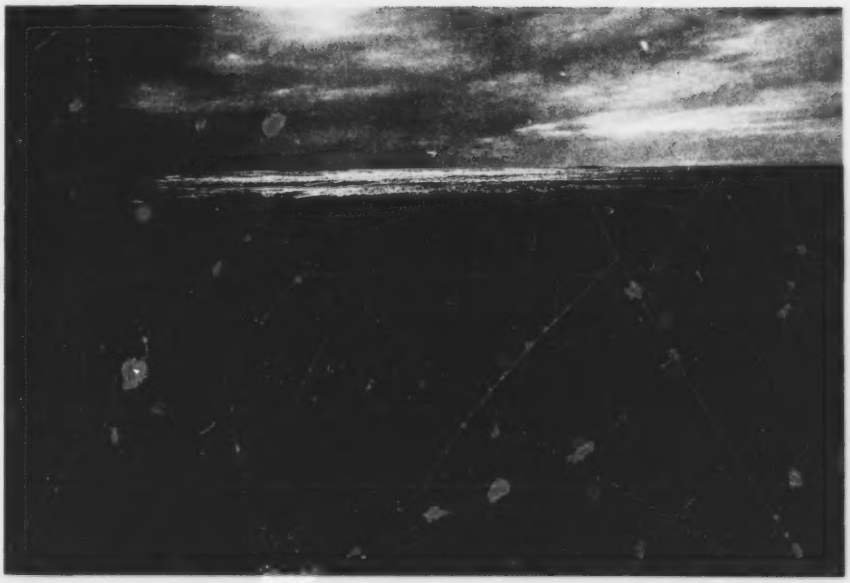
Canadian Agtechnology Partners

Fencing Central Stock Water and Solar Pumping.
Restricting cattle access to shorelines of stock water ponds and providing water to a trough using a solar-powered pump will maintain water quality, reduce the need for cleanout, and protect vegetation for birds and other wildlife.



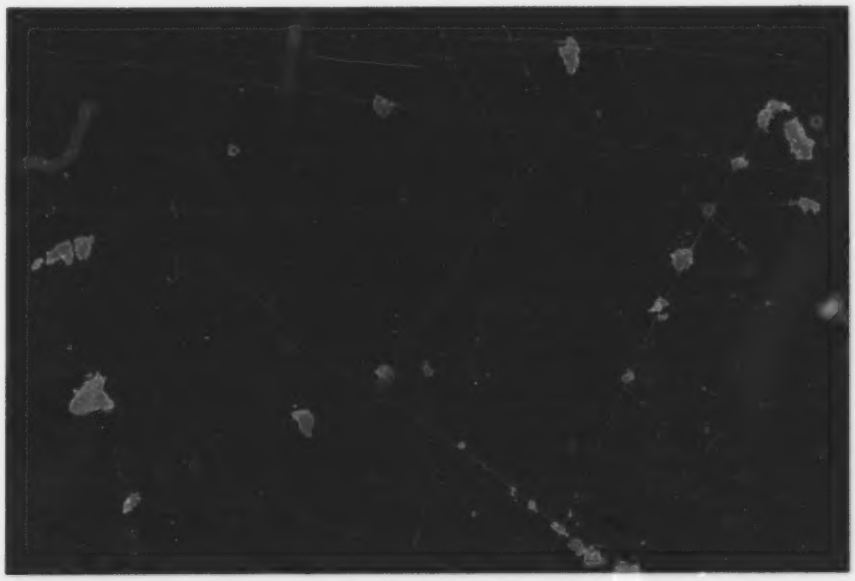
C. Wallis

Dugouts lack a shallow water zone where vegetation can grow and wildlife can feed and seek shelter. Other than being a source of drinking water, they are of little value to wildlife unless fenced so that emergent plants can grow at the sloped ends and on spoil banks.



C. Wallis

Stock dams provide long, sinuous areas of shallow water with emergent vegetation cover. As many as four breeding pairs of waterfowl per acre of water will be attracted to these impoundments. The tall emergent vegetation will support many broods of ducklings and songbirds. Seasonal lowering of water levels in these ponds also provides a nutritional source of preserved livestock forage.

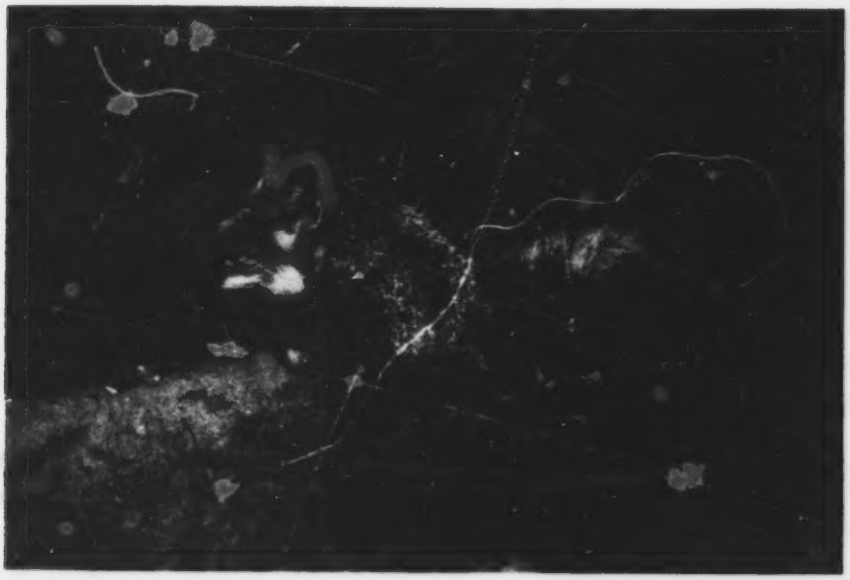


G. Trottier

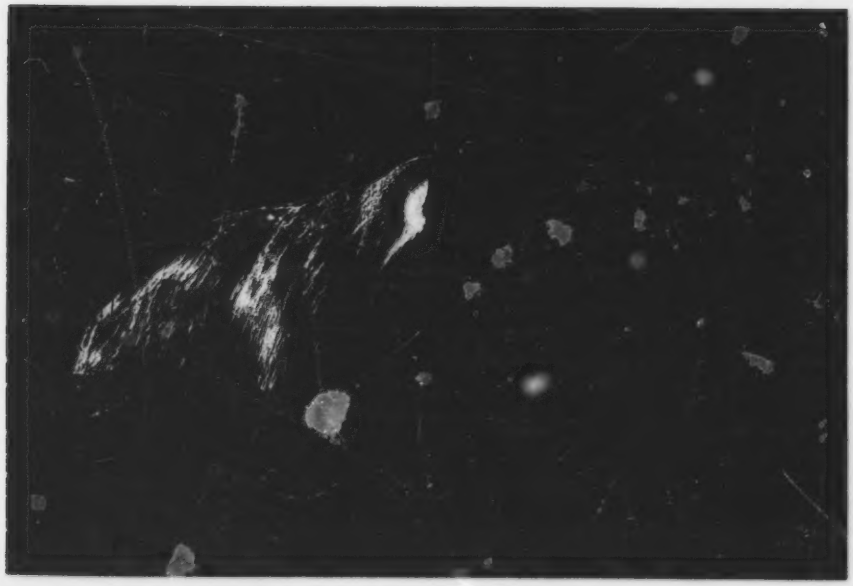
Tree and shrub patches bordering prairie streams are important habitat for wildlife. Try to manage livestock distribution through herding or winter grazing in order to protect these sensitive sites from overuse. Unless livestock are kept out of river breaks, forage supplies on the less sensitive table lands will not be efficiently utilized during the summer grazing season.

D. Wood

Attracting birds of prey such as Ferruginous Hawks by establishing nesting structures can be an effective measure for ground squirrel control in the Mixed Prairie region.



L. Carbyn



D. Wood

Native grassland not only provides a low input forage source, it serves as a refuge for rare and endangered species. Converting these areas to seeded forage is a costly business which destroys predator habitat. The Swift fox and the Badger control rodent and insect pests.

Prescribed Burning

Prescribed burning is the use of fire as a management tool under specified conditions for burning a predetermined area. It implies planning and care.

History tells us that when conditions on prairie grasslands were conducive to burning, lightning strikes and fires set by Plains Indians burned over vast areas. Therefore, prairie grasslands are adapted to fire.

It is a fact that some grasslands in the Canadian prairie cannot be maintained without fire. In areas where moisture conditions meet the needs of trees and shrubs, it is difficult to control these plants without mechanical, chemical, or fire disturbance. Fire is the cheapest, most environmentally-friendly method of controlling woody growth.

Effects of Prescribed Burning

It is important to know that burning can do the following:

- Remove unpalatable dead plant matter
- Enhance flowering and seed production
- Topkill shrubs and trees
- Create a seedbed
- Control and reduce undesirable, introduced grasses and forbs
- Provide browse at a height that grazers can reach
- Reduce fire hazard
- Control insect pests

While fire is rarely used in the Canadian prairie region to maintain or improve grasslands for livestock grazing, there is a place for this technique. It has been tested with excellent results at the University of Alberta Ranch near Kinsella as a cost-effective method to clear Aspen poplar stands and expand the Fescue grassland for cattle grazing.

Burning can complement grazing practices in these ways:

- Removes plant litter from ungrazed, non-preferred sites and stimulates succulent regrowth which will attract cattle
- Increases grazing capacity by reducing grazing pressure on overgrazed areas
- Returns nutrients to the soil system as natural fertilizer
- Stimulates grass seed production
- Increases seed germination
- Increases broadleaf plants, many of which are nitrogen-fixers

Prescribed burning fits in well with rotation-grazing systems. Burns can be restricted to fenced paddocks so that the whole pasture does not have to be burned and cattle can be kept off the newly-burned area until the grasses have had a chance to re-grow.

G. Trottier

One of the most chronic pasture-management problems in the northern and eastern fringes of the Mixed Prairie, the Fescue Prairie, and the remaining Tallgrass Prairie, is woody invasion. This is largely attributable to elimination of fire disturbance.

L. Carbyn

Fescue grassland area burned in mid-May to control woody invasion. Green-up on burned areas attracts wildlife and livestock grazing. If burning a pasture, try to burn the whole unit which will be open to grazing at any one time. Newly-burned areas must be protected from cattle grazing until the grasses have had a chance to re-grow and store energy reserves. Heavy cattle grazing in August can be used to kill aspen and willow suckers that sprout following a burn.

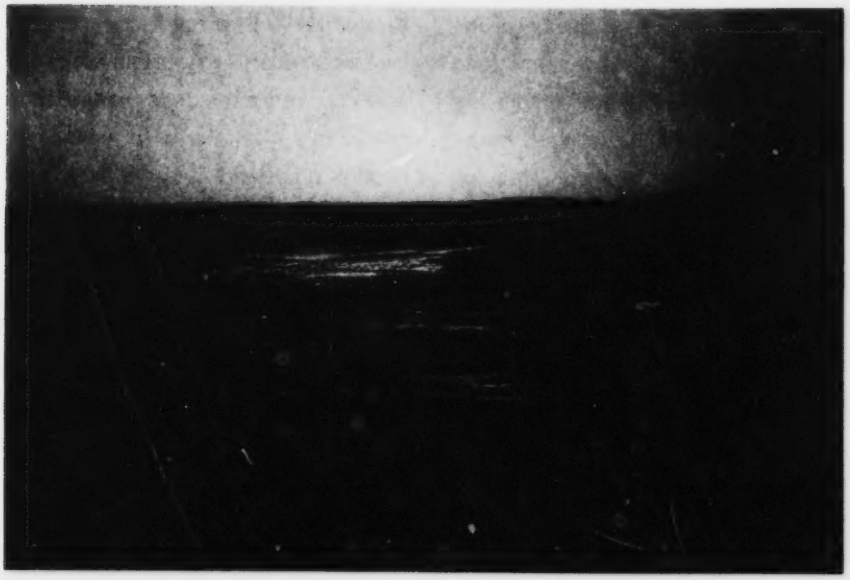
Regional Applicability of Prescribed Burning

Landowners and researchers know that fire may be necessary to reclaim or maintain grassland in the moist regions of the Mixed Prairie, the Fescue Prairie, and the Tallgrass Prairie. In the arid reaches of the Mixed Prairie where annual precipitation is less than 40 centimetres per year, the need for fire has not been determined. In those areas, woody encroachment is not a problem and burns are certain to have a prolonged detrimental effect on forage production and soil erosion.

Experience with prescribed burning lies largely with managers of Crown land. Traditionally, these managers have had sufficient resources to conduct burns, they are under fewer liability constraints, and they have had to find economical methods to manage vegetation on large tracts of land. Individual landowners should not attempt to burn without examination of their plans by a management specialist.

D. Wood

Open ground created by fire attracts Burrowing owls and ground-nesting shorebirds which will not normally occupy tall vegetation.



R. Wroe

Extensive tracts of Mixed grassland burned during August 1990. Scientists have not defined the benefits or necessity of burning in these arid grasslands.

Living Prairie Museum

Grasses of the Tallgrass Prairie respond well to June burns (area on the left). Big bluestem is a warm-season grass which is not damaged by a June burn since its main period of growth begins in late June.

Timing Prescribed Burning

Safety factors and plant species responses will determine when to burn. You will need expert advice on both of these considerations.

All plants are most vulnerable to defoliation during their most active period of growth, when the plants' energy resources are lowest. As this varies among species, tailor any burning plans to the species of concern in your management objectives. Grasses have growing points in the basal crown near or below the ground surface, so they are better adapted to fire than woody plants or forbs. Some grasses grow primarily in the cooler period of spring or fall (cool-season grasses) while others grow best during the heat of the summer (warm-season grasses). Timing the fire can be managed either to favour or to control these different groups.

Do not burn in a drought year. Plants respond more slowly when drought-stressed, and basal crowns and roots can be damaged when the soil is not moist. Overall, burning when it is too dry will increase the soil-erosion hazard.

Burns should be conducted only on the basis of accurate spot weather forecasts and a strict set of criteria for acceptable weather conditions. Prevailing wind direction for your area will determine ignition plans and placement of fireguards. Changes in wind direction can result in poor burns or cause fires to burn out of control. Arrange for spot weather forecasts well in advance to ensure you know conditions the day before you burn, the day of the burn, and the day after.

Provincial Fire Regulations

Each province has established regulations governing burning permits, fire season, fire control, personnel and equipment requirements, and liabilities. In order to ensure a safe burn, persons responsible must comply with these regulations.

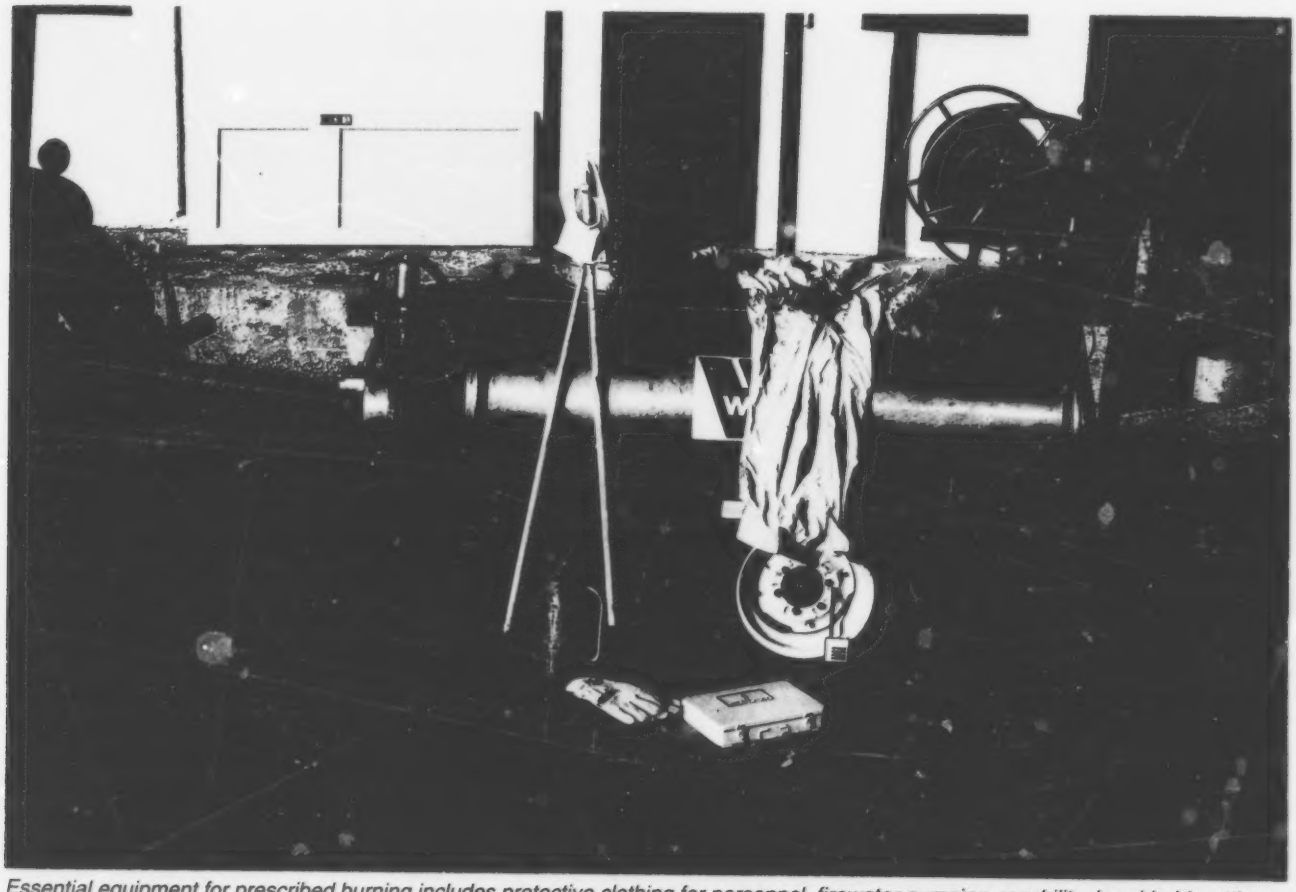
Information on burning techniques, safety requirements, equipment, personnel, legal obligations, and notification requirements can be obtained from your local municipal or forestry fire control officer.

Frequency of Burning

Historical records reveal that burns did not occur very often under natural conditions in a given area. To maintain a healthy grassland, it is not likely that landowners would need to burn more often than once every 5-10 years, depending on which precipitation zone their land is located in. The drier the environment, the lower the frequency of burning required.

If exotic plants or woody invaders are to be controlled, one burn may not be enough. Two or more are usually required to reduce the abundance of such plants. These are termed "reclamation" burns. Periodic additional burns needed to prevent invasion are known as "maintenance" burns.

In the Tallgrass Prairie dominated by warm-season grasses, a maintenance burn every 3-5 years in late May to late June, depending on when spring arrives, gives best results. In the Mixed and Fescue Prairie, earlier spring burns ensure that the dominant cool-season grasses are not damaged. One maintenance burn every 5-10 years would be sufficient.



E. Driver

Essential equipment for prescribed burning includes protective clothing for personnel, firewater pumping capability, hand-held wetting devices, rakes, shovels, rubber flappers, and a drip torch for safe ignition. Farm equipment such as chemical sprayers, mowers and cultivators can be used for fire control and construction of fire guards.

E. Driver

G. Trottier

Mowing and burning a fireguard (top) is preferable to the destructive practice of bulldozing or discing the grassland sod (bottom). The mowed vegetation is allowed to cure, the perimeter is wetted and the cured vegetation is burned using a backfire technique. Cultivated fields, waterbodies and roads, if conveniently located, will be effective fireguards.

E. Driver

Setting the Main Fire (Ignition):
The main burn area is ignited with a backfire from the downwind fireguard. Once this blackened area is wide enough, backfires are set along the inside of the side-wind fireguards working toward the upwind guard. Then the headfire is set across the upwind fireguard. "The surround-burn technique," as it is called, serves to widen the fireguards before the headfire is set.

G. Trottier

Small prairie wetlands (potholes) may become choked with woody and herbaceous vegetation. Periodic burning can reclaim these basins as suitable waterfowl-breeding habitat. A slow-moving root burn in July and August will deepen the basin and create openings in the dense vegetation. Manage so that you achieve an ideal brood pond which consists of 50 per cent open water interspersed with clumped emergent plants. It is best to rotate burning among the available wetlands over a series of years, rather than burn all of them in a single year. By using this method, sufficient cover is left available for nesting.

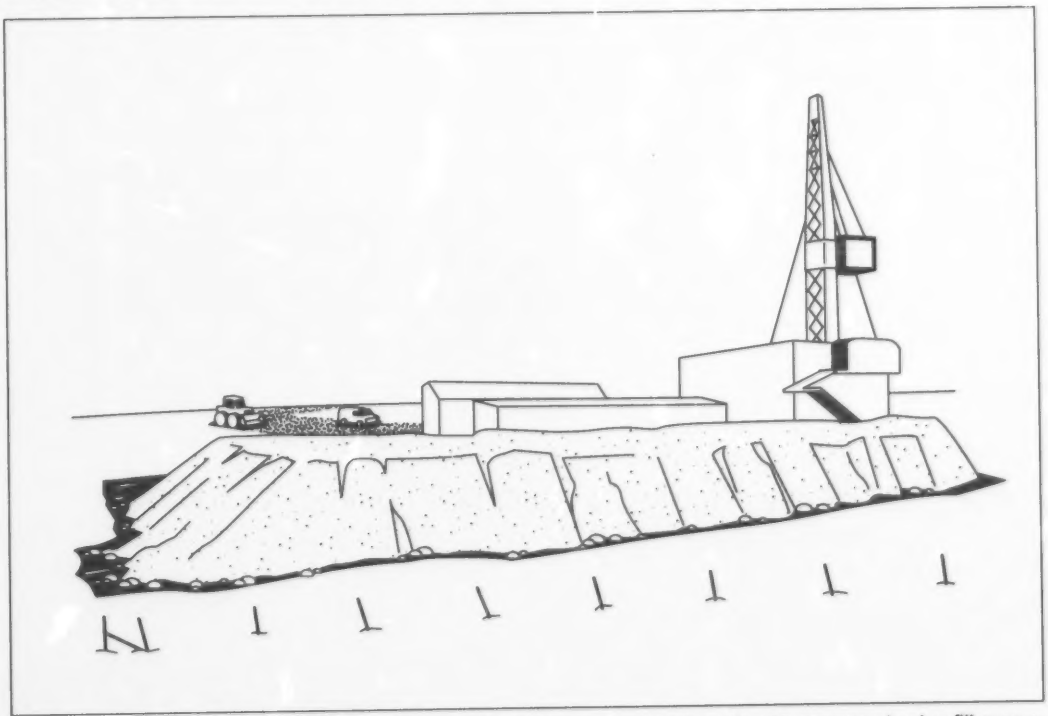
Grassland Restoration

Restoration is defined as a process undertaken "to bring back or rebuild to original condition" (*Oxford Concise Dictionary*). Most of us view restoration efforts only in the context where an activity has destroyed not only the plant cover, but also the wildlife and the soil. We need to consider restoration in a broader context. Proper grazing techniques and prescribed burning, as discussed earlier, are restorative techniques.

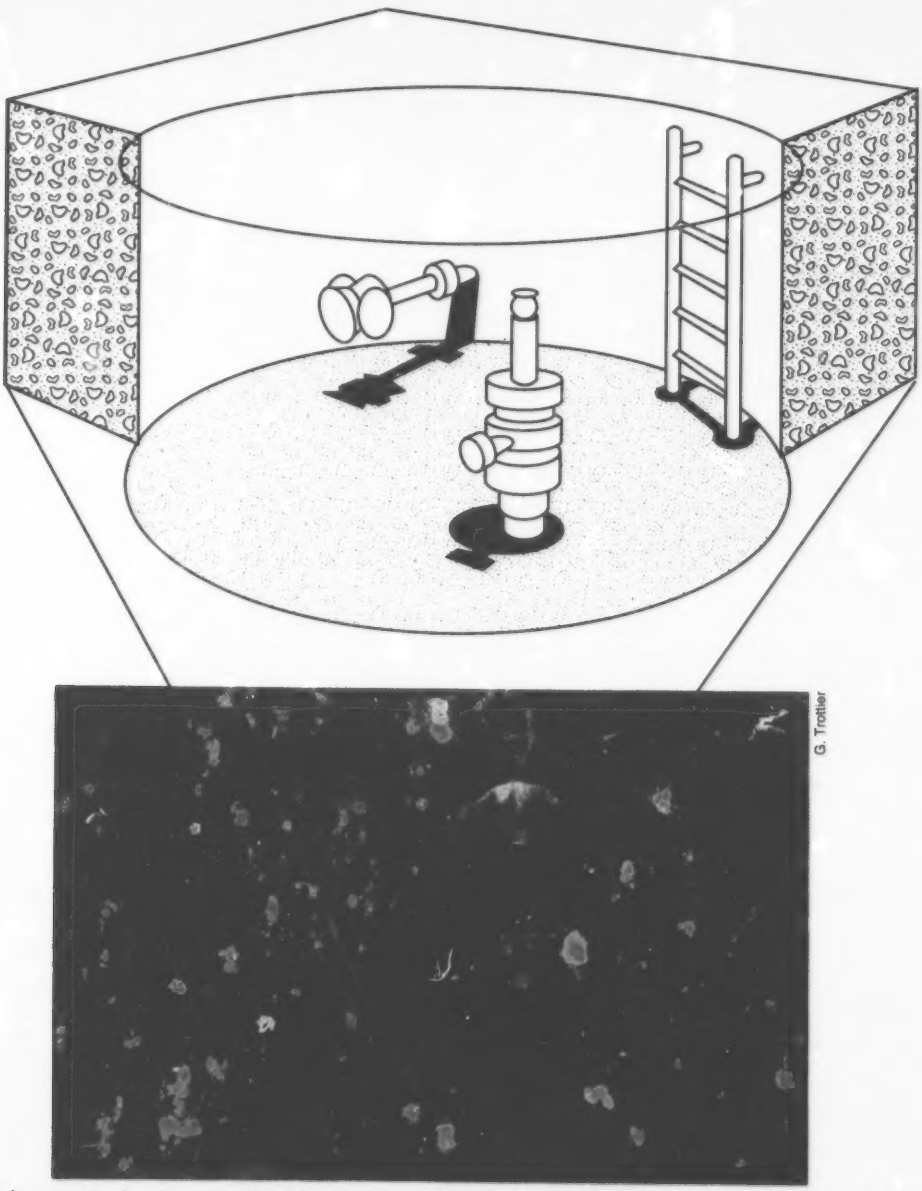
The following section illustrates some restoration techniques as well as possibilities for protection of grassland vegetation cover.

Mitigating Sod Disturbance

Petroleum exploration and production activities are commonplace in the grassland region. While grazing leaseholders of Crown land are subject to certain restrictions on grazing management and are forbidden to cultivate the lease, there are few restrictions imposed on resource companies to minimize disturbance. Nevertheless, industry concern for the grassland environment has fostered some effective techniques for minimizing the impact of industrial activities in the grasslands.



Restricting drilling activity to the winter season, packing temporary haul roads with snow and using fill over a woven "muskeg" pad to support the rig site protects the prairie sod. The "muskeg" pad technique may be very expensive; cheaper options such as topsoil salvage (see P. 76) may be more appropriate depending on site conditions and other operational constraints. Disturbed areas should be reseeded with native species rather than with introduced cultivars.



G. Trottier

Caisson well-head emplacements developed by the Alberta Energy Company for CFB Suffield minimize drill-site disturbance and virtually eliminate the visual intrusion. Because the drill site is not cut to fit the operation, vegetation disturbance is restricted to a small area which quickly revegetates naturally from adjacent seed sources and those in the soil.

B. Adams

This pipeline trenching operation kept surface disturbance to a minimum. The company refrained from stripping a right of way which would have left a larger area to be revegetated. Natural revegetation was allowed to reclaim the trench spoil.

G. Trottier

Flax straw bales are used to stabilize road cuts and well pads in the Middle Sandhills, CFB Suffield. Sand which collects between the bales is stable enough to allow plants to root. The unpalatable flax straw precludes damage by hungry wildlife and it resists weathering.

Seeding Native Grassland Plants

Reclamation through seeding is a technique available even to the hobbyist who wishes to establish a small meadow or yard plot for aesthetic reasons. Throughout the growing season, grass and forb seeds can be collected by hand from patches of remnant prairie along right-of-ways or idle rangelands. A hand-held, gas-powered grass cutter with a bag attachment or even a grass scythe can be used to cut and collect quantities of cured seed heads. Always seek permission before collecting seed from private or Crown property and avoid collecting seed from weedy areas.

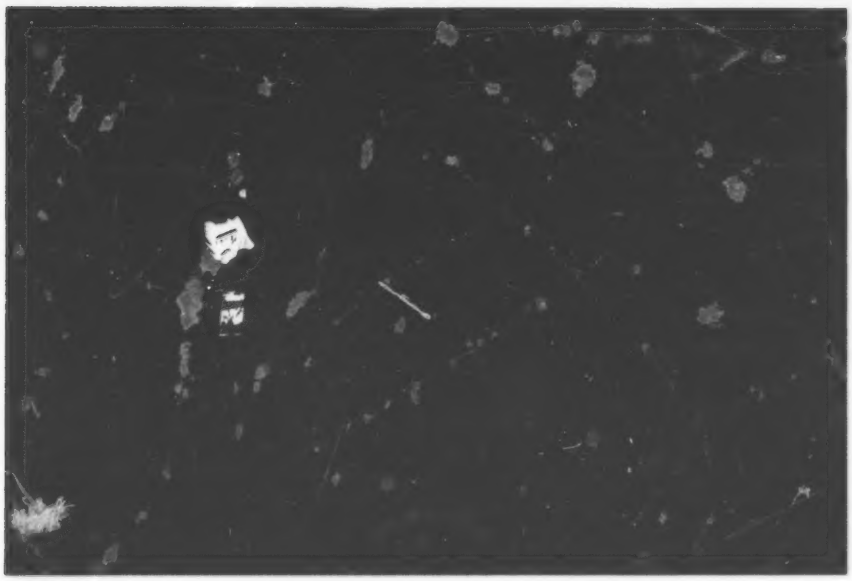
Reclamation seed may also be purchased. There are now at least four reputable native seed dealers in Western Canada (see Appendix 3) who can supply native grass and flower seeds from Canadian locations. Always insist on guaranteed native genetic stock, and be careful; some suppliers often package "wildflower" mixes that contain exotics that are nothing more than common weeds.

Seeding projects require some planning before work can begin. Investigation of the following will ensure good decision-making: seed availability and cost; seed collection sites; amount of seed required; the appropriate planting method; and management required to perpetuate the plantings. Check the listings in Appendix 4 for expert advice.

Native Cultivars Available from Commercial Seed Suppliers

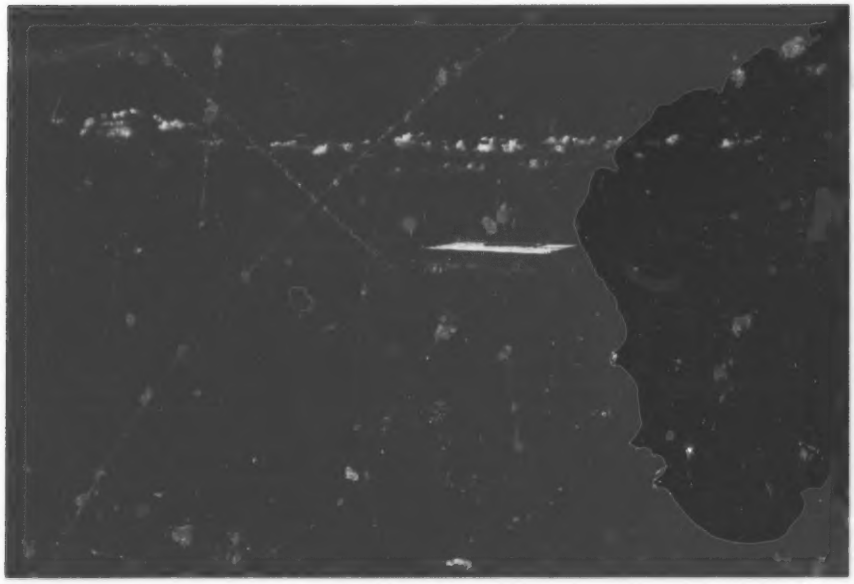
Species	Applicable Grassland Zone		
	Tallgrass Prairie	Fescue Prairie	Mixed Prairie
Needle and Thread			X
Green Needle Grass	X	X	X
Western Wheatgrass	X		X
Slender Wheatgrass		X	X
Northern Wheatgrass		X	X
Streambank Wheatgrass	X	X	
Bluebunch Wheatgrass		X	
June Grass	X	X	X
Sand Grass			X
Rough Fescue		X	X
Big Bluestem	X		X
Little Bluestem	X		X
Blue Grama Grass	X		X
Indian Grass	X		
Tufted Hairgrass*		X	
Reed Canary Grass*		X	
Sideoats Grama	X		
Fringed Brome		X	X
Western Porcupine Grass	X	X	X
Switch Grass	X		
Tall Dropseed	X		

*Adapted to wet meadow conditions



J. Morgan

Hand collection or use of a bag-equipped weed cutter are sufficient methods for collecting small amounts of native seed.



D. Collicutt

Accessible stands of ungrazed grassland can be mechanically harvested with a seed stripper to obtain large volumes of seed to supply larger projects. Combines are also useful for this purpose. Tests have shown that some models of the Gleaner-produced combine have superior sieve and cylinder configurations for separating native grass seed.

Large-scale plantings are unlikely to be of practical value to landowners except in cases where formerly cultivated acreages are to be seeded back to permanent cover for grazing or hay production. Under the current soil erosion control programs sponsored by federal and provincial agriculture departments (see Appendix 5), incentives are available to assist landowners with purchasing seed and renting equipment to establish perennial forage crops. Several native cool and warm-season grasses are now commercially available for this purpose; however, be aware that the cost of native seed and site preparation may be quite high (custom rates may total $1,500-$2,000/acre of restored prairie).

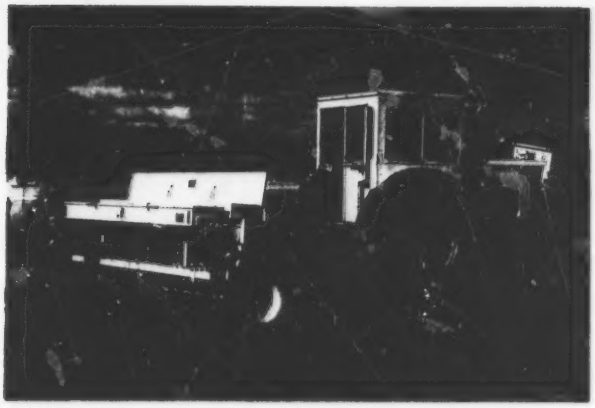
Following these principles for establishment of native species in reclamation projects will yield the best results.

Planning:

- Identify the prairie type appropriate to the site
- Plant species appropriate to the prairie type
- Determine the appropriate relative percentage of seeds of different species within each type to be planted

Seed Harvesting and Care:

- A prescribed spring burn induces higher seed production in the collection site
- Hand harvesting at several stages throughout the growing season provides a large variety of seeds
- Mechanical harvesting is often efficient for acquiring large amounts of the dominant grass; use straight-combining when dominant grass seed is ripe
- Combined seed can be spread on a drying floor and then mixed with hand-collected seed to increase total species in the seed mix
- Seed treatment will greatly enhance germination rates. Grass seed should be dried, forb seeds should be dampened, and legumes can be scarified between layers of sandpaper. Most prairie seeds like to be cold and damp for a winter before germinating.



D. Collicutt

Specialized drills are best for seeding. Use of an inert carrier like cracked wheat will carry light fluffy grass seeds through the drill. No-till attachments are available for seeding native grasses into the sod to renovate grassland in poor condition. These drills can be borrowed or leased from Agriculture Canada PFRA, forage associations, and some conservation districts.

Oldman River Dam Project

Topsoil Relocation. The top 10 centimetres of prairie sod salvaged from development sites can be spread as top dressing to reclaim other areas. Revegetation develops quickly from the soil seed bank and underground stems (rhizomes). The soil can be stabilized by stapling down commercial mulch mats if wind erosion is a problem.

Oldman River Dam Project

Native hay is spread over topsoil as a mulch to serve as a seed source. This reclamation technique has just recently been developed as an alternative to direct seeding in areas where wind erosion is a hazard.

M. Conrad

T. Muir

Artificial nesting dens have proven effective for attracting and re-introducing the endangered Burrowing Owl to its former range. Plastic or wooden nest boxes are dug into the ground for this purpose.

Management Problems and Possible Restoration Techniques

Problem	Techniques
Declining range condition	Reduce stocking rate. Delay spring grazing. Use rotation grazing systems. Drill native grasses and forbs into the sod and delay grazing.
Tree and shrub invasion	Selectively burn patches (repeat burns with 1-2 year intervals will allow fuel build-up). Repeated fall burns are effective. Use heavy grazing to eliminate sprouting suckers. Do maintenance burns every 5-10 years to prevent further invasion.
Sod disturbance is anticipated	Restrict activity to winter season. Set out protective ground pads. Minimize or avoid top-soil stripping and allow natural revegetation to proceed. Strip the sod and transplant elsewhere.
Grassland destroyed	Reseed with native grass cultivars and interseed with native grass forbs. Broadcast native seed onto disturbed area and mulch with native hay. For small areas use sod transplants if available.
Invasion by exotic cultivars	Smooth bromegrass: repeated spring burns when in 5-leaf stage (tiller elongation to flowering). Crested wheatgrass: plow down plantations and work soil, then reseed with native grasses; control small patches with broad spectrum herbicide, burn the residue, then reseed with native grasses. Kentucky bluegrass: repeated early-spring burns.

Appendix 1
Glossary of Terms

Animal Unit. Considered to be one mature cow (455kg) or the equivalent based on an average daily forage consumption of 15 kg of dry matter.

Animal Unit Month (AUM). The amount of forage required by an animal unit for one month.

Carrying Capacity. Maximum stocking rate possible on a sustained yield basis without causing damage to range vegetation or related resources.

Climax. The final or most mature plant community capable of perpetuation under the prevailing climate and soil conditions.

Community. Populations of plant and animal organisms living in a given area.

Cool-Season Grass. Grass of temperate origin which makes the major portion of its growth in spring under an optimal temperature range of 15-25 degrees Celsius, and requiring 1/5 full sunlight for full photosynthesis.

Cover.
1) The combined aerial parts of plants expressed as percent of the total area in question.

2) Shelter and protection for wildlife.

Dominant Species. Plants or groups of plants which, in terms of their abundance, coverage, or size, have considerable influence or control upon the conditions of existence for associated species.

Forage. All browse and herbaceous foods that are available to grazing animals.

Forb. Any herbaceous plant other than those in the grass, sedge, and rush families.

Montane. Vegetation zone of the foothills and mountain valleys at low elevation where grassland mixes with evergreen forest.

Native. Part of original flora and fauna of the area in question.

Population. Groups of individuals of the same species.

Range. Land that supports a cover of herbaceous or shrubby vegetation useful for grazing animals.

Range Condition. The state of health of a specific range area. The current productivity of a range, relative to what that range is naturally capable of producing.

Range Site. A distinctive kind of rangeland as a result of physical features. It has the potential to support a typical assemblage of plant species different from that of other sites.

Stocking Rate. Actual number of animals on a specific area at a specific time. The area of land allowed per animal unit for the entire grazeable period of the year. Expressed as Animal units/unit area (AU/Ha) or Area/AUM (Ha/AUM).

Warm-Season Grass. Plants of tropical origin making most of their growth in the late spring and summer under an optimum range of 30-40 degrees Celsius, and full light saturation.

Appendix 2
Recommended Reading

Plant Identification Guides

Aiken, S.G., and S.J. Darbyshire. *Grass Genera of Western Canadian Cattle Rangelands* (Monograph). Ottawa: Agriculture Canada Research Branch, Monograph No. 29, 1983.

Best, K.F., J. Looman and J.B. Campbell. Prairie Grasses: Identified and Described by Vegetative Characters. Ottawa: Agriculture Canada Publication 1431, 1971.

Looman, J., and K.F. Best. Budd's Flora of the Canadian Prairie Provinces. Ottawa: Agriculture Canada Publication 1662, 1979.

Grazing and Range Management

Abougouendia, Z.M. *Range Plan Development: A Practical Guide to Planning for Management and Improvement of Saskatchewan Rangeland.* Regina: Saskatchewan Agriculture, New Pasture and Grazing Technologies Project, 1990.

Adams, B.W., W.D. Willms, S. Smoliak, and R.A. Wroe. *Range: Its Nature and Use.* Edmonton: Alberta Forestry, Lands and Wildlife, Public Lands Division Publication, 1986.

Alberta Forestry, Lands and Wildlife — Public Lands. *Range Notes.* 530 – 8 Street S., Lethbridge T1J 4C7.

Pyle, W., and W. Johnson eds. *Managing Saskatchewan Rangeland.* Regina: Saskatchewan Agriculture, New Pastures and Grazing Technologies Project, 1990.

Smoliak, S., W.D. Willms, R.A. Wroe, B.W. Adams and G. Ehlert. *Range Pastures in Alberta.* Edmonton: Alberta Agriculture Publication Agdex 134/14-8, 1988.

Smoliak, S., W.D.Willms, and N.W. Holt. *Management of Prairie Rangeland.* Ottawa: Agriculture Canada Publication 1589/E, 1990.

Wroe, R.A., S. Smoliak, B.W. Adams, W.D.Willms and M.L. Anderson. *Guide to Range Conditions and Stocking Rates for Alberta Grasslands.* Edmonton: Alberta Forestry, Lands and Wildlife, Public Lands, 1988.

Prescribed Burning

Higgins, K.F., A.D. Kruse, and J.L. Piehl. *Prescribed Burning Guidelines in the Northern Great Plains.* Brookings, South Dakota: United States Fish and Wildlife Service, South Dakota State University, United States Department of Agriculture Cooperative Publication EC760, 1989. (Zip code for mailing address: 57007)

Higgins, K.F., A.D. Kruse, and J.L. Piehl. *Effects of Fire in the Northern Great Plains.* Brookings, South Dakota: United States Fish and Wildlife Service and Cooperative Extension Service, South Dakota State University, 1990. (Zip code: 57007)

Kjellsen, M.J., and K.F. Higgins. *Grasslands: Benefits of Management by Fire.* Brookings, South Dakota: South Dakota Cooperative Fish and Wildlife Research Unit, South Dakota State University publication FS857, 1990. (Zip code: 57007)

Wright, H.A., and A.W. Bailey. *Fire Ecology and Prescribed Burning in the Great Plains: A Research Review.* Ogden, Utah: United States Department of Agriculture Forest Service General Technical Report INT-77, 1980. (Zip code: 84401)

Grassland Conservation

Joyce, J. *Prairie Grasslands Guidebook: A Management Manual.* Winnipeg: Manitoba Natural Resources Public Information Unit, 1990.

World Wildlife Fund. *Prairie Conservation Action Plan: 1989-1994.* Toronto: World Wildlife Fund, 1989.

Wildlife Habitat Management

Green, J.E., and Salter, R.E. *Methods of Reclamation of Wildlife Habitat in the Canadian Prairie Provinces.* Edmonton: Delta Environment Management Group (prepared for Environment Canada and Alberta Recreation, Parks and Wildlife Foundation), 1987.

Holroyd, G.L., ed. Prairie Hawks and Owls — A Land-owners' Guide. Canadian Wildlife Service, 2nd Floor, 4999 – 98 Avenue, Edmonton T6B 2X3, 1992.

Poston, H.J., and R.K. Schmidt. *Wildlife Habitat: A Handbook for Canada's Prairies and Parklands.* Edmonton: Environment Canada, Wildlife Service, 1981.

Grassland Restoration

Alberta Environment, Forestry, Lands and Wildlife, ERCB and Special Areas Board, 1991. Calgary. Petroleum Activity on Native Prairie: Guidelines for Surface Disturbances. ERCB, 12th Floor, 640 – 5th Avenue S.W., Calgary T2P 3G4.

Collicutt, D.R., and J.P. Morgan. Tallgrass Prairie Restoration Project, 1990 report. 1991. Wildlife Habitat Canada. Suite 301, 1704 Carling Avenue, Ottawa T2A 1C7.

Milwaukee County Department of Parks, Recreation and Culture. *Prairie Propagation Handbook.* Wehr Nature Centre, 1989. (Address: 5879S.92 Street, Hales Corners, Wisconsin, 53130).

Appendix 3
Native Seed Suppliers

Big Sky Wholesale Seeds Inc.,
Box 852,
Shelby, Montana, 59974 USA
Phone: (406) 434-5011

Cacklin Seed Company,
West 17300 Cacklin Avenue,
Post Falls, Idaho, 83854 USA

Golden West Seeds Ltd.,
1108 6 St S.E.,
Calgary, Alberta, T2G 2Y2 Canada

North-Plan/Mountain Seed,
Box 9107,
Moscow, Idaho, 83843 USA

Plant Materials Centre
United States Soil
Conservation Service
P.O. Box 1458
Bismarck, North Dakota, 58502 USA

Prairie Habitats: Native Prairie
Nursery
Box 1,
Argyle, Manitoba, ROC 1B0 Canada
Phone: (204) 467-9371

Prairie Restorations, Inc.,
P.O. Box 327
Princeton, Minnesota, 55371 USA
Phone: (612) 389-4342

Prairie Seeds Ltd., Box 428
Nisku, Alberta, T0C 2G0 Canada
Phone: (403) 955-7345

Rangeland Seeds
Box 928
Vulcan, Alberta, T0L 2B0 Canada
Phone: (403) 485-6448

Rocky Mountain Seed Service,
Box 215,
Golden, British Columbia, V0A 1H0
Canada

Rogne-Schumaker Seeds,
RR2, Box 231,
Kindred, North Dakota, 58501 USA
Phone: (701) 428-3839

Appendix 4
Sources of Expert Assistance

Plant Identification

The following centres provide plant identification services upon request. In addition, your local agriculture extension representative or municipal weed inspector can provide assistance.

Manitoba

Department of Botany (Herbarium)
Buller Building
University of Manitoba
Winnipeg, Manitoba
R3T 2N2
Phone: (204) 474-9368

Manitoba Agriculture
25 Tupper Street (North)
Portage la Prairie, Manitoba
R1N 3K1
Phone: (204) 857-9711 ext. 398
(Grassland specialist and weeds agronomist)

Agriculture Canada Research Station
Box 61D
Brandon, Manitoba
R7A 5Z7
Phone: (204) 728-7234

Agriculture Extension Centre
1129 Queens Avenue
Brandon, Manitoba
R7A 1L9
Phone: (204) 726-6359

Habitat Section, Wildlife Branch
Manitoba Department of Natural Resources
1495 St. James Street
Winnipeg, Manitoba
R3H 0W9
Phone: (204) 945-7761

Manitoba Museum of Man and Nature
190 Rupert Avenue
Winnipeg, Manitoba
R3B 0N2
Phone: (204) 956-2830

Department of Plant Science
University of Manitoba
Room E309, Plant Science Building
76 Dafoe Road
Winnipeg, Manitoba
R3T 2N2
Phone: (204) 474-8221

Manitoba Naturalists Society
302 – 128 James Avenue
Winnipeg, Manitoba
R3D 0N8
Phone: (204) 943-9029

Saskatchewan

Department of Crop Science and Plant Ecology
University of Saskatchewan
Saskatoon, Saskatchewan
S7N 0W0
Phone: (206) 966-4943

Department of Biology
University of Regina
Regina, Saskatchewan
S4S 0A2
Phone: (306) 585-4145, 585-4254
(Herbarium)

Saskatchewan Museum of Natural History
(Annex) 2340 Albert Street
Regina, Saskatchewan
S4P 3V7
Phone: (306) 787-2814 (Annex)

Regina Research Station —
Agriculture Canada
Box 440, 5000 Wascana Parkway
Regina, Saskatchewan
S4P 3A2
Phone: (306) 780-7400

Alberta

Alberta Environmental Centre
Plant Sciences
Bag Service 4000
Vegreville, Alberta
T0B 4L0
Phone: (403) 427-2711
(Rite) 632-6761

Regional Crops Laboratory
Provincial Building
Box 10
Olds, Alberta
T0M 1P0
Phone: (403) 556-4282

Department of Biological Sciences
University of Calgary
2500 University Drive NW
Calgary, Alberta
T2N 1N4
Phone: (403) 220-5261, 220-5262
(Herbarium)

Department of Botany
Room B-414
Biological Sciences Centre
University of Alberta
Edmonton, Alberta
T6G 2E9
Phone: (403) 492-3483, 492-5523
(Herbarium Room B-613)

Alberta Provincial Museum and Archives
12845 – 102 Avenue
Edmonton, Alberta
T5N 0M6
Phone: (403) 427-1730, 427-1731
(Natural History)

Prairie Restoration

Alberta Environment Centre
Plant Sciences
Bag Service 4000
Vegreville, Alberta
TOB 4L0
Phone: (403) 427-2711
(Rite) 632-6761

Alberta Native Plant Council
Box 4524
Postal Station 'SE'
Edmonton, Alberta
T6E 5G4

Cottonwood Consultants Ltd.
615 Deercroft Way S.E.
Calgary Alberta
T2J 5V4

Fort Whyte Environmental Centre
1961 McCreary Road
Winnipeg, Manitoba
R3Y 1G5
Phone: (204) 895-7001

Living Prairie Museum
2795 Ness Avenue
Winnipeg, Manitoba
R3J 3S4
Phone: (204) 832-0167

Manitoba Provincial Parks Branch
Beudry Park TGP Restoration
4th Floor, 258 Portage Avenue
Winnipeg, Manitoba
R3C 0B6
Phone: (204) 945-4148

Prairie Habitats
Box 1
Argyle, Manitoba
R0C 0B0
Phone: (204) 467-9371

Appendix 5
Financial Incentive Programs

There are several conservation programs underway in the prairie provinces that could be applied to for funding assistance for native grassland conservation projects. These programs essentially deal with either soil and water conservation or wildlife habitat management and protection. In all these programs, funds are available to landowners for the following:

- leases to protect permanent cover and wetlands
- costs of establishing permanent vegetation cover
- costs of undertaking conservation farming practices (e.g. rotation grazing)

Interested individuals or groups should contact the following agencies to determine qualification requirements and receive further information.

Prairie-Wide Programs

1. North American Waterfowl Management Plan — Prairie Habitat Joint Venture:
   - waterfowl habitat protected through long-term leases with landowners (native grasslands qualify)
   - financial assistance to develop conservation farming practices including grazing systems on native grassland
   - financial assistance to develop dense nesting cover (native grass seed can be used)
   - purchase prime waterfowl habitat including native grassland, a joint project of the Canadian Wildlife Service (Environment Canada), Provincial Wildlife and Agriculture agencies, Saskatchewan Wetland Conservation Corporation, Ducks Unlimited Canada, Wildlife Habitat Canada, and Agriculture Canada (PFRA).

   Contact: The nearest office of the agencies listed above.

2. Prairie Care:
   - financial assistance to develop conservation farming practices that provide waterfowl nesting habitat and protect wetlands

   This is a component program of the North American Waterfowl Management Plan administered by Ducks Unlimited.

   Contact: Ducks Unlimited Canada, 1190 Waverley Street, Winnipeg, Manitoba, R3T 2E2, (204) 477-1760, Alberta (403) 489-2002, Saskatchewan (306) 567-0424, or contact the nearest Ducks Unlimited Canada regional office in your province.

3. Ducks Unlimited Canada:
   - non-financial incentives (stock watering, fencing) to landowners for wetland protection and upland habitat improvements through conservation farming techniques

   Contact: See DU Canada listings above.

4. Permanent Cover Program:
   - cultivated lands on class IV or poorer soils eligible for a subsidy to seed to permanent cover; additional funds available for long-term leases to maintain permanent cover (native grass seed can be used)
   - organizations receive financial assistance to purchase eligible lands and manage for permanent cover

   This is a Federal/Provincial soil conservation initiative administered by Agriculture Canada — Prairie Farm Rehabilitation Administration (PFRA) delivered jointly with provincial agricultural departments.

   Contact: Nearest provincial agriculture extension office or the PRFA, Motherwell Building, 1901 Victoria Avenue, Regina, Saskatchewan, S4P 0R5; 401-1 Wesley Avenue, Winnipeg, Manitoba, R3C 4C6; Canada Place, Suite 1620, 9700 Jasper Avenue, Edmonton, Alberta, T5J 4C3.

5. Wildlife Habitat Canada (WHC):
   - private stewardship program which provides financial support or public recognition to landowners endeavouring to protect unique tracts of native habitat

   Contact: WHC, 1704, Carling Avenue, Suite 301, Ottawa, Ontario, K2A 1C7, (613) 722-2090.

Alberta Programs

1. Buck for Wildlife — Landowner Habitat Program:
- incentives to protect land qualifying as important wildlife habitat from destructive farming practices (native grasslands are eligible)
- incentives to adopt certain conservation farming techniques that will improve wildlife habitat (grazing systems)

Contact: Habitat Branch, Alberta Fish and Wildlife Division, 2nd Floor, 9920-108 Street, Edmonton, Alberta, T5K 2C6, (403) 427-9506 (or the nearest Alberta Fish and Wildlife Office).

2. Soil Conservation Area Program (SCAP):
- up to 75% of the cost paid for seeding saline or erosion-prone soils to perennial vegetation cover (native seed will qualify)

Contact: Any district agriculturalist or regional soil and crop specialist.

Manitoba Programs

1. Critical Wildlife Habitat:
- funds available to lease, purchase, or manage critical wildlife habitats in agricultural areas (native grasslands qualify)

Contact: Manitoba Department of Natural Resources, Box 24, 1495 St. James Street, Winnipeg, Manitoba, R3H 0W9, (204) 945-7750.

2. Habitat Trust Program:
- may purchase land to be set aside as wildlife habitat

Contact: Manitoba Wildlife Federation, 1770 Notre Dame Avenue, Winnipeg, Manitoba, R3E 3K2, (204) 633-5967.

3. Tallgrass Prairie Conservation Project:
- provides management assistance to landowners interested in preserving Tallgrass Prairie holdings, particularly in the central Red River Valley area

Contact: Tallgrass Prairie Project, Box 24, 1495 St. James Street, Winnipeg, Manitoba, R3H 0W9, (204) 945-2395.

4. Prairie Patron Program:
- purchases key Tallgrass Prairie areas, accepts donations for prairie conservation

Contact: Manitoba Naturalists Society, 302-128 James Avenue, Winnipeg, Manitoba, R3B 0N8, (204) 943-9029.

5. H.E.L.P. Program:
- leases, purchases and manages native prairie and wetland areas in the Prairie Pothole District of Manitoba

Contact: H.E.L.P. Program, P.O. Box 28, Shoal Lake, Manitoba, R0J 1Z0, (204) 759-2717.

Saskatchewan Programs

1. Fish and Wildlife Development Fund:
- funds available to purchase critical wildlife habitat from landowners

Contact: Saskatchewan Parks and Renewable Resources, Wildlife Branch, 3211 Albert Street, Regina, Saskatchewan, S4S 5W6, (306) 787-2309, or any district conservation officer.

2. Habitat Trust Program:
- land purchased, or accepted as a donation, to hold in trust as wildlife habitat

Contact: Saskatchewan Wildlife Federation, Box 788, Moose Jaw, Saskatchewan, S6H 4P5, (306) 693-9022, or a local branch of this organization.

3. Save Our Soils Program:
- a major component of the Canada-Saskatchewan Agreement on Soil Conservation
- producers apply for technical material and financial assistance to implement soil and wildlife habitat conservation activities on their lands, including crop residue management, grassed waterways, forage establishment, green manure, field shelterbelts, and wildlife complementary multi-use field shelterbelts establishment and maintenance

Contact: Local Agricultural, Development and Diversification (ADD) Boards, extension agrologists, soils and crops specialists, PFRA area conservationists, or Saskatchewan Soil Conservation (SSCA) regional soil conservationists.

Appendix 6

Habitat Preferences of Selected Wildlife Species

Habitat preferences of some typical wildlife species of Canadian prairie Grasslands

Tall, dense grassland (lightly grazed)	Medium height grassland (moderately grazed)	Short grassland (heavily grazed)
Birds		
Baird's Sparrow	Lark Bunting	Chestnut-collared Longspur
Clay-coloured Sparrow	Upland Sandpiper	Horned Lark
Common Yellowthroat	Western Meadowlark	Mountain Plover
Grasshopper Sparrow	Spraque's Pipit	Killdeer
Leconte's Sparrow	Long-billed Curlew	McGowan's Longspur
Red-winged Blackbird	Willet	
Savannah Sparrow		
Mammals		
Thirteen-lined Ground Squirrel	Deer Mouse	Richardson's Ground Squirrel
Meadow Vole	Swift Fox	Black-tailed Prairie Dog
Ord's Kangaroo Rat		
Reptiles and Amphibians		
Great Plains Toad		Short-horned Lizard

Typical nesting habitat of ground-nesting waterfowl

Species	Nest site vegetation	Nest distance from nearest waterbody
Northern Pintail	short grass and forbs	1-3 kms
Mallard	tall, dense shrub patches or grass-shrubs	1-3 kms
Northern Shoveler	grass and forbs	<.5 km
Blue-winged Teal	grass and forbs	<.25 km
Wigeon	grass-shrub patches	<.5 km
Gadwall	grass-shrub patches	<.5 km

Appendix 7
Plant Species Mentioned in This Guide

LEGEND:

Grassland Distributions:
TGP – Tallgrass Prairie
MP – Mixed Prairie
FP – Fescue Prairie
SH – Sandhills

Grazing Response:
D – Decreaser Species
I – Increaser Species
Inv – Invader Species

	Grassland Distribution					
	Grasses and Sedges					
Common/ Scientific Names	**TGP**	**MP**	**FP**	**SH**	**Grazing Response**	**Growing Season**
Big Bluestem *Andropogon gerardii*	x	x			D	Warm
Blue Grama Grass *Bouteloua gracilis*		x	x	x	I	Cool
Bluebunch Wheatgrass *Agropyron Spicatum*			x		D	Cool
Canada Wild Rye *Elymus Canadensis*		x	x	x	D	Cool
Crested Wheatgrass *Agropyron Cristatum*		x	x	x	Inv	Cool
Green Needle Grass *Stipa Viridula*	x	x			D	Cool
Hooker's Oatgrass *Helictotrichon Hookeri*			x		D	Cool
Indian Rice Grass *Oryzopsis Hymenoides*				x	D	Cool
Indian Grass *Sorghastrum Nutans*	x				D	Warm
June Grass		x	x		I	Cool
Kentucky Bluegrass *Poa Pratensis*	x	x	x		Inv	Cool
Little Bluestem *Andropogon Scoparius*	x	x			D	Warm
Needle and Thread *Stip Comata*		x		x	D	Cool

Grasses and Sedges						
Common/ Scientific Names	**TGP**	**MP**	**FP**	**SH**	**Grazing Response**	**Growing Season**
Northern Wheatgrass *Agropyron Dasystachyum*		x	x		D	Cool
Parry's Oatgrass *Danthonia Parryi*			x		I	Cool
Plains Rough Fescue *Festuca Hallii*		x	x		D	Cool
Prairie Dropseed *Sporobolus Heterolepis*	x				I	Warm
Rough Fescue *Festuca Campestris*			x		D	Cool
Sand Grass *Calamovilfa Longifolia*				x	D	Cool
Sand Dropseed *Sporobolus Cryptandrus*				x	D	Cool
Sideoats Grama *Bouteloua Curtipendula*	x				D	Warm
Slender Wheatgrass *Agropyron Trachycaulum*		x	x		D	Cool
Smooth Bromegrass *Bromus Inermis*	x	x	x		Inv	Cool
Streambank Wheatgrass *Agropyron Riparium*			x		D	Cool
Switchgrass *Panicum Virgatum*	x				D	Warm
Tall Dropseed *Sporobolus Asper*	x				I	Cool
Thread-leaved Sedge *Carex Filifolia*		x	x		I	Cool
Tufted Hairgrass *Deschampsia Caespitosa*	x		x		D	Cool
Western Porcupine Grass *Stipa Spartea*	x	x	x		D	Cool
Western Wheatgrass *Agropyron Smithii*		x			D	Cool
Wild Oatgrass *Danthonia Intermedia*		x	x		I	Cool

Forbs

Common/ Scientific Names	TGP	MP	FP	SH	Grazing Response
American Hedysarum *Hedysarum Alpinum*		x	x		D
Brittle Prickly-pear Cactus *Opuntia Fragilis*		x			I
Crowfoot Violet *Viola Pedatifida*		x	x		
Culver's Root *Veronicastrum Virginicum*		x			
Dotted Blazing Star *Liatris Punctata*		x			D
Dwarf False Indigo *Amorpha Nana*		x			
Flexile Lupine *Lupinus Sericeus*			x		I
Golden Alexanders *Zizia Aurea*	x				I
Indian Breadroot *Psoralea Esculenta*	x	x			I
Lance-leaved Psoralea *Psoralea Lanceolata*				x	I
Large-flowered Paintbrush *Castilleja Sessiflora*				x	
Leadplant *Amorpha Canescens*	x				I
MacKenzie's Hedysarum *Hedysarum Mackenzii*			x		D
Meadow Blazing Star *Liatris Lingulistylis*	x	x	x	x	D
Mountain Shootingstar *Dodecatheon Conjungens*			x		I
Obscure Evening-primrose *Oenothera Breviflora*	x	x			
Prairie False Dandelion *Nothocalais Cuspidata*			x		
Prairie Crocus *Anemone Patens*		x	x		I
Prairie Sage *Artemisia Ludoviciana*	x	x	x		I

Forbs					
Common/ Scientific Names	**TGP**	**MP**	**FP**	**SH**	**Grazing Response**
Prairie Smoke *Geum Triflorum*		x	x		D
Prairie Sunflower *Helianthus Couplandii*		x		x	
Prickly-pear Cactus *Opuntia Polyacantha*		x		x	I
Purple Prairie Clover *Petalostemon Purpureum*	x	x			D
Pursh's Milk-vetch *Astragalus Purshii*		x			I
Sand Puffs *Abronia Micrantha*				x	
Scarlett Mallow *Malvastrum Coccineum*		x			I
Seneca Root *Polygala Senega*			x		D
Silver-leaf Psoralea *Psoralea Argophylla*	x	x			I
Silvery Lupine *Lupinus Argenteus*			x		I
Skeletonweed *Lygodesmia Juncea*		x		x	I
Small Lupine *Lupinus Pusillus*				x	I
Small White Lady's Slipper *Cypripedium Candidum*	x				
Spanish Bayonet *Yucca Glauca*		x			
Western Silvery Aster *Virgulus Sericeus*	x				I
Western Spiderwort *Trandescantia Occidentalis*		x		x	
Western White-fringed Orchid *Platanthera Praeclara*	x				I
White Evening Primrose *Oenothera Nuttalii*				x	

Forbs

Common/ Scientific Names	TGP	MP	FP	SH	Grazing Response
White Prairie Clover *Petalostemon Candidum*		x			D
Wood Lily *Lilium Philadelphicum*		x	x		

Shrubs

Common/ Scientific Names	TGP	MP	FP	SH	Grazing Response
Aspen Poplar *Populus Tremuloides*	x	x	x	x	D
Broomweed *Gutierrezia Sarothrae*		x			I
Choke Cherry *Prunus Virginiana*	x	x	x	x	D
Creeping Juniper *Juniperus Horizontalis*		x		x	I
Pasture Sage *Artemisia Frigida*		x	x		I
Prickly Rose *Rosa Vesicularis*	x				I
Sandbar Willow *Salix Interior*	x	x	x	x	
Silver Sage *Artemisia Cana*		x		x	I
Shrubby Cinquefoil *Potentilla Fruticosa*	x		x		I
Thorny Buffaloberry *Shepherdia Argentea*		x		x	
Western Snowberry *Symphoricarpos Occidentalis*	x	x	x	x	I
Wild Rose *Rosa Acicularis*	x	x	x	x	I

Acknowledgements

The following people kindly provided helpful comments on the draft version of this publication. Without their assistance this publication would not have been completed:

Landowners
Wayne Heller
Charlie Russell
John Rebus
Steve Kubasek
Vern Arnold
Wendy Murphy
Lyle Olsen
Harold Rath

Land Management Specialists
Karen Smith
John P. Morgan
David Henry
JoAnne Joyce
Amanda Jones
Cliff Wallis
Brent Wark
Doug Fraser
Arnold Kruse
Walter Willms
Robert Coupland
Richard Baydack
George Chu
Barry Adams
Jeffrey Green
Judy Archer
Zoheir Abouguendia
Cheryl Bradley
Samuel Kirby
Ed Hennan
David Moore
Stan Rowe
Richard Rounds
Dale Hjertaas
Bob Kaufman
Bert Poston

Plant Illustrations
John Maywood

Bird and Mammal Illustrations
Sandra Hastie

Maps
Susan MacEachran